REGALIS · SOCIETAS · CANADENSIS

DIVERSIS EODEM STUDIIS NITIMUR

MDCCCLXXXII

MÉMOIRES

ET

COMPTES RENDUS

DE

LA SOCIÉTÉ ROYALE

DU

CANADA

TROISIÈME SÉRIE—TOME VIII.

SÉANCE DE MAI 1914

EN VENTE CHEZ
JAS. HOPE ET FILS, OTTAWA; LE CIE COPP-CLARK (LIMITÉE) TORONTO
BERNARD QUARITCH, LONDRES, ANGLETERRE
1915

PROCEEDINGS

AND

TRANSACTIONS

OF

THE ROYAL SOCIETY

OF

CANADA

THIRD SERIES—VOLUME VIII.

MEETING OF MAY 1914

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BERNARD QUARITCH, LONDON, ENGLAND
1915

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THE ROYAL SOCIETY OF CANADA

FOUNDER: HIS GRACE THE DUKE OF ARGYLL, K.T., &c.
(WHEN GOVERNOR-GENERAL OF CANADA IN 1882)

OFFICERS FOR 1914-15

HONORARY PRESIDENT:

HIS ROYAL HIGHNESS THE DUKE OF CONNAUGHT, K.G., &c., &c.

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ADDITIONAL MEMBERS OF COUNCIL:

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SIR JAMES GRANT, K.C.M.G.
W. D. LESUEUR, LL.D.,
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LAWRENCE M. LAMBE, F.G.S.
FRANK D. ADAMS, Ph.D., F.R.S., F.G.S.

THE ROYAL SOCIETY OF CANADA

LIST OF MEMBERS, 1914-1915

The date given is the date of election; c, denotes a charter member.

Section I.—LITTÉRATURE FRANÇAISE, HISTOIRE, ARCHÉOLOGIE, SOCIOLOGIE, ETC.

c—Bégin, S. E. Le Cardinal L.-N., archevêque de Québec, docteur en théologie, *Québec.*

1905—Bruchési, S. G. Mgr Paul, archevêque de Montréal, docteur en théologie, *Montréal.*

1902—Chapais, Thomas, membre du Conseil législatif, docteur ès lettres, chevalier de la Légion d'honneur, *Québec.*

1914—Choquette, Ernest, membre du Conseil législatif, *Saint-Hilaire.*

1890—David, L.-O., sénateur, chevalier de la Légion d'honneur, *Montréal.*

1885—De Celles, A.-D., C.M.G., LL.D., docteur ès lettres, chevalier de la Légion d'honneur, *Ottawa.*

1902—Gagnon, Ernest, docteur ès lettres, officier de l'Instruction publique, *Québec.*

1898—Gérin, Léon, *Coaticooke.*

1911—Gosselin, Monsignor Amédée-E., recteur de l'Université Laval, maître ès arts, *Québec.*

1892—Gosselin, L'Abbé Auguste, docteur ès lettres, *Saint-Charles-de-Bellechasse.*

1909—Langelier, Sir François, lieutenant-gouverneur de la province de Québec, docteur en droit, *Québec.*

c—Le May, Pamphile, docteur ès lettres, *Deschaillons, près Québec.*

1908—Lemieux, Rodolphe, membre du Conseil privé du Canada, docteur en droit, officier de la Légion d'honneur, *Ottawa.*

1911—Lozeau, Albert, officier d'Académie, *Montréal.*

1908—Mignault, Pierre-Basile, C. R., docteur en droit, *Montréal.*

1913—Montigny, Louvigny Testard de, officier de l'Instruction publique, *Ottawa.*

1914—Montpetit, Edouard, LL. L., diplômé de l'Ecole des Sciences politiques de Paris, officier de l'Instruction publique, *Montréal.*

1909—Myrand, Ernest, docteur ès lettres, *Québec.*

1903—Paquet, Monsignor Louis-Ad., docteur en théologie, *Québec.*

1899—Poirier, Pascal, sénateur, chevalier de la Légion d'honneur, *Shédiac.*

1894—Poisson, Adolphe, docteur ès lettres, *Arthabaskaville.*

1903—Prud'homme, L.-A., juge, *Saint-Boniface.*

1908—Rivard, Adjutor, maître ès arts, docteur ès lettres, *Québec.*

c—Routhier, Sir Adolphe-B., C. G. C. Saint-Grégorie, docteur en droit et ès lettres, *Québec.*

1904—Roy, L'Abbé Camille, docteur ès lettres, licencié ès lettres de l'Université de Paris, *Québec.*

1911—Roy, Pierre-Georges, *Lévis.*

c—Sulte, Benjamin, docteur ès lettres, ancien président général, *Ottawa.*

Section II.—ENGLISH LITERATURE, HISTORY, ARCHÆOLOGY, SOCIOLOGY, ETC.

1901—Bryce, Rev. George, M.A., LL.D., *Winnipeg* (ex-president).
1902—Burwash, Rev. Nathaniel, S.T.D., LL.D., Chancellor of Victoria College, *Toronto.*
1911—Burpee, Lawrence J., F.R.G.S., Sec'y, International Joint Commission, *Ottawa.*
1894—Campbell, W. Wilfred, LL.D., Dominion Archives, *Ottawa.*
1906—Coyne, J. H., M.A., LL.D., *St. Thomas.*
1906—Cruikshank, Col. E. A., *Calgary.*
c—Denison, Col. G. T., B.C.L., *Toronto* (ex-president; life member).
1905—Doughty, Arthur G., C.M.G., Litt. D., Dominion Archivist, *Ottawa.*
1913—Eaton, Rev. A. W. H., M.A., D.C.L., *Truro.*
1911—Grant, W. Lawson, M.A. (Oxon), Queen's University, *Kingston.*
1913—Hill-Tout, Charles, *Abbotsford, B.C.*
1902—Howley, Most Rev. M.F., D.D., Archbishop of St. John's, *St. John's, Nfld.*
1913—Hutton, Maurice, M.A., LL.D., University of Toronto, *Toronto.*
1905—James, C. C., C.M.G., LL.D., 144 St. George St., *Toronto.* (Life member).
1910—Jones, Rev. Arthur E., S.J., St. Mary's College, *Montreal.*
1910—King, Hon. W. L. Mackenzie, C.M.G., Ph.D., *Ottawa.*
1913—Leacock, Stephen, B.A., Ph.D., McGill University, *Montreal.*
1903—LeSueur, W. D., B.A., LL.D., *Ottawa* (ex-president).
1902—Lighthall, William Douw, M.A., B.C.L., F.R.S.L., *Montreal.*
1898—Longley, Hon. Mr. Justice, LL.D., *Halifax.*
1910—Macphail, Andrew, B.A., M.D., *Montreal.*
1914—Mavor, James, Ph.D., University of Toronto, *Toronto.*
1911—McLachlan, R. Wallace, F.R.N.S., *Montreal.*
1914—Peterson, William, C.M.G., LL.D., Principal McGill University, *Montreal.*
1913—Phillips-Wolley, Clive, F.R.G.S., *Somenos, B.C.*
1906—Raymond, Ven. Archdeacon W. O., LL.D., *St. John.*
1914—Robertson, J. Ross, *Toronto.*
1899—Scott, D. Campbell, Deputy Superintendent General of Indian Affairs, *Ottawa.*
1900—Scott, Rev. Frederick George, *Quebec.*
1906—Shortt, Adam, C.M.G., M.A., LL.D., *Ottawa.*
1910—Thomson, E. W., F.R.S.L., *Ottawa.*
1911—Walker, Sir Edmund, C.V.O., *Toronto*
1905—Wood, Lt.-Col. William, *Quebec.*
1908—Wrong, George M., M.A., University of Toronto, *Toronto.*

Section III.—MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

1914—Allan, Francis Barclay, M.A., Ph.D., University of Toronto, *Toronto.*
1909—Allen, Professor Frank, M.A., Ph.D., University of Manitoba, *Winnipeg.*
1899—Baker, Alfred, M.A., LL.D., University of Toronto, *Toronto.*
1902—Barnes, H. T., D.Sc., F.R.S., McGill University, *Montreal.* (Life member).
1913—Burton, E. Franklin, B.A., Ph.D., University of Toronto, *Toronto.*
1897—Dawson, W. Bell, M.A., Ma.E., D.Sc., M. Inst. C.E., *Ottawa.*
c—Deville, E., LL.D., Surveyor-General, *Ottawa.*
c—Dupuis, N. F., M.A., F.R.S.E., Queen's University, *Kingston.*

1891—Ellis, W.H., M.D., University of Toronto, *Toronto.*

1910—Eve, A. S., D.Sc., McGill University, *Montreal.*

1909—Fields, John Charles, Ph.D., F.R.S., University of Toronto, *Toronto.*

c—Fleming, Sir Sandford, K.C.M.G., LL.D., C.E., *Ottawa* (ex-president; life member).

c—Girdwood, G. P., M.D., McGill University, *Montreal.* (Life member).

1902—Glashan, J. C., LL.D., *Ottawa.*

1891—Goodwin, W. L., D.Sc., Queen's University, *Kingston.*

1908—Harkness, James, M.A. (Cantab.& Lond.). McGill University, *Montreal.*

1911—Herdt, Louis A., D.Sc., E.E., McGill University, *Montreal.*

c—Hoffman, G. C., F.I.C., M.M.S., LL.D., *Ottawa.*

1914—Johnson, F. M. G., M.Sc., Ph.D., F.I.C., McGill University, *Montreal.*

1891—Keefer, T. C., C.M.G., LL.D., C.E., *Ottawa* (ex-president.)

1911—Kenrick, Francis B., M.A., Ph.D., University of Toronto, *Toronto.* (Life member).

1908—King, W. F., C.M.G., LL.D., (ex-president) Dominlon Observatory, *Ottawa*

1910—Klotz, Otto, LL.D., F.R.A.S., Dominion Observatory, *Ottawa.*

1911—Lang, William R., D.Sc., F.I.C., University of Toronto, *Toronto.*

c—Loudon, James, M.A., LL.D., *Toronto* (ex-president).

1913—Mackenzie, A. Stanley, B.A., Ph.D., D.C.L., Dalhousie University, *Halifax.*

1900—McGill, Anthony, B.Sc., LL.D., Chief Analyst, *Ottawa.*

1909—McIntosh, Douglas, Ph.D., McGill University, *Montreal.*

1903—McLennan, J. C., Ph.D., University of Toronto, *Toronto.*

1893—McLeod, C. H., M.E., McGill University, *Montreal.* (Life member).

1911—McClung, Robert K., M.A., D.Sc., B.A. (Cantab.), University of Manitoba, *Winnipeg.*

1899—Miller, W. Lash, Ph.D., University of Toronto, *Toronto.* (Life member).

1910—Plaskett, J. S., B.A., D.Sc., Dominion Observatory, *Ottawa.*

1896—Ruttan, R. F., M.D., C.M., D.Sc., McGill University, *Montreal.*

1899—Shutt, F. T., M.A., D.Sc., F.I.C., F.C.S., Chemist, Central Experimental Farm, *Ottawa.* (Life member).

1913—Stansfield, Alfred, D.Sc., A.R.S.M., McGill University, *Montreal.*

1901—Stupart, R. F., Superintendent, Meteorological Service, *Toronto.*

1909—Tory, H. M., M.A., D.Sc., LL.D., *Edmonton.*

SECTION IV.—GEOLOGICAL AND BIOLOGICAL SCIENCES.

1902—Adami, J. G., F.R.S., M.A., M.D., (Cantab. and McGill), LL.D., F.R.S.E., McGill University, *Montreal.*

1896—Adams, Frank D., Ph.D., D.Sc., F.R.S., F.G.S., McGill University, *Montreal.*

1900—Ami, Henry M., M.A., D.Sc., F.G.S., *Ottawa.* (Life member).

c—Bailey, L. W., M.A., Ph.D., University of New Brunswick, *Fredericton.*

c—Bell, Robert, B.Ap.Sc., M.D., LL.D., F.G.S., F.R.S., *Ottawa.*

1910—Bensley, Benj. A., Ph.D., University of Toronto, *Toronto.*

1892—Bethune, Rev. C. J. S., M.A., D.C.L., *Guelph.* (Life member).

1911—Brock, Reginald W., M.A., F.G.S., F.G.S.A., Deputy Minister of Mines, *Ottawa.*

1911—Brodie, T. G., M.D., F.R.S., University of Toronto, *Toronto.*

1909—Buller, A. H. Reginald, D.Sc., Ph.D., University of Manitoba, *Winnipeg.*

1885—Burgess, T. J. W., M.D., *Montreal.* (Life member).

1900—Coleman, A. P., M.A., Ph.D., F.R.S., University of Toronto, *Toronto.*

1912—Dowling, D. B., B.Sc., Geological Survey, *Ottawa.*
1913—Faribault, E. Rodolphe, B.Ap.Sc., Geological Survey, *Ottawa.*
1912—Faull, J. H., B.A., Ph.D., University of Toronto, *Toronto.*
c—Grant, Sir J.A., K.C.M.G., M.D., F.G.S., *Ottawa* (ex-president).
1910—Harrison, Francis C., B.S.A., D.Sc., Macdonald College, *Ste. Anne de Bellevue, Que.*
1913—Hewitt, C. Gordon, D.Sc., F.E.S., Central Experimental Farm, *Ottawa.*
1913—Huard, LAbbe Victor A., D.D., *Quebec.*
1912—Knight, A. P., M.A., M.D., Queen's University, *Kingston.*
1900—Lambe, Lawrence M., F.G.S., Geological Survey, *Ottawa.* (Life member).
1911—Leathes, John B., B.A., F.R.C.S., B.Ch. (Oxon.), University of Toronto, *Toronto.*
1900—Macallum, A. B., Ph.D., F.R.S., University of Toronto, *Toronto.*
1888—Mackay, A. H., LL.D., B.Sc., Superintendent of Education, *Halifax.* (Life member).
1909—MacKenzie, J. J., B.A., M.B., University of Toronto, *Toronto.*
1913—McConnell, Richard G., B.A., Geological Survey, *Ottawa.*
1912—McInnes, William, B.A., Geological Survey, *Ottawa.* (Life member).
1909—McMurrich, J. P., M.A., Ph.D., University of Toronto, *Toronto*
c—Matthew, G. F., M.A., D.Sc., *St. John, N.B.* (Life member).
1911—Miller, Willet G., B.A., LL.D., F.G.S.A., *Toronto.* (Life member).
1913—Moore Clarence L., M.A., Dalhousie University, *Halifax.*
1908—Nicholls, A. G., M.A., M.D., McGill University, *Montreal.*
1902—Prince, E. E., B.A., LL.D., F.L.S., Dominion Commissioner of Fisheries, *Ottawa.* (Life member).
1914—Roddick, Sir Thos. G., Kt., M.D., C.M., McGill University, *Montreal.*
c—Saunders, W., C.M.G., LL.D., F.L.S., F.E.S.A., *Ottawa* (ex-president).
1910—Tyrrell, Joseph B., M.A., B.Sc., F.G.S., *Toronto.*
1909—Vincent, Swale, M.D., D.Sc., University of Manitoba, *Winnipeg.*
1910—White, James, F.R.G.S., Conservation Commission, *Ottawa.*
1912—Willey, Arthur, F.R.S., McGill University, *Montreal.*

CORRESPONDING MEMBERS.

Bonney, T. G., D.Sc., LL.D., F.R.S., *London, England.*
Bryce, Rt. Hon. Viscount, D.C.L., *London, England.*
Ganong, Dr. W. F., *Northampton, Mass.*
Hanotaux, Gabriel, de l'Académie française, 21, rue Cassette, *Paris.*
Lamy, Etienne, secrétaire perpétuel de l'Académie française, 3, place d'Iéna, *Paris.*
Lorin, Henri, professeur d'histoire coloniale à l'Université de Bordeaux, 23, quai des Chartrons, *Bordeaux.*
Metzler, W. H., Ph.D., F.R.S., Edin., Syracuse University, *Syracuse, N.Y.*
Osborn, Dr. Henry Fairfield, Columbia University, *New York, N.Y.*
Ostwald, Prof. Dr. Wilhem, *Leipzig.*
Parker, Sir Gilbert, M.P., D.C.L., *London, England.*
Salone, Emile, professeur d'histoire au Lycée Condorcet, 68, rue Jouffray, *Paris.*
Scudder, Dr. S. H., *Cambridge, Mass., U.S.A.*
Thomson, Sir Joseph J., O.M., F.R.S., *Cambridge, England.*

RETIRED MEMBERS.

c—Bourassa, Napoléon, *Montreal.*
Callendar, Hugh L., M.A., (Cantab.), F.R.S., *London, England.*
1899—Charland, Père Paul V., Litt. D., *Quebec.*
1909—Colby, Chas. W., M.A., McGill University, *Montreal.*
1897—Cox, John, M.A., (Cantab.), *London, England.*
1894—Dawson, S. E., C.M.G., Litt. D., *Westmount* (ex-president).
1891—Fowler, James, M.A., Queen's University, *Kingston.*
1904—Gordon, Rev. Charles W., LL.D., *Winnipeg.*
c—Haanel, E., Ph.D., Director of Mines, *Ottawa.*
1894—Harrington, W. H., *Ottawa.*
1909—MacBride, Ernest W., M.A., F.R.S., *London, England.*
Mair, Charles, Prince Albert, *Sask.*
Mills, T. Wesley, 45 Warrington Crescent, Maida Vale, *London, England.*
c—Murray, Rev. J. Clark, LL.D., *Montreal.*
c—Osler, Sir W., Bt., M.D., F.R.C.P., F.R.S., *Oxford, England.*
Owens, R. B., M.Sc., Franklin Institute, *Philadelphia, U.S.*
1898—Parkin, G. R., C.M.G., LL.D., *London, England.*
1900—Poole, H. S., M.A., F.G.S., *Spreyton, Stoke, Guildford, England.*
c—Reade, John, LL.D., F.R.S.L., *Montreal.*
1890—Roberts, C. G. D., M.A., *London, England.*
Rutherford, E., B.A., (Cantab.), A.M., F.R.S., *Manchester, England.*
c—Watson, J., M.A., LL.D., *Kingston.*
1900—Willison, Sir John S., LL.D., *Toronto.*
1910—Wilson, Harold A., F.R.S., *Houston, Texas.*
c—Wright, R. Ramsay, M.A., B.Sc., *Bournemouth, England* (ex-president)

LIST OF PRESIDENTS

1882–1883	Sir J. W. Dawson.
1883–1884	L'honorable P. J. O. Chauveau.
1884–1885	Dr. T. Sterry Hunt.
1885–1886	Sir Daniel Wilson.
1886–1887	Monsignor Hamel.
1887–1888	Dr. G. Lawson.
1888–1889	Sir Sandford Fleming, K.C.M.G.
1889–1890	L'abbé Casgrain.
1890–1891	Very Rev. Principal Grant.
1891–1892	L'abbé Laflamme.
1892–1893	Sir J. G. Bourinot, K.C.M.G.
1893–1894	Dr. G. M. Dawson, C.M.G.
1894–1895	Sir J. Macpherson LeMoine.
1895–1896	Dr. A. R. C. Selwyn, C.M.G.
1896–1897	Most Rev. Archbishop O'Brien.
1897–1898	L'honorable F. G. Marchand.
1898–1899	T. C. Keefer, C.M.G.
1899–1900	Rev. William Clark, D.C.L.
1900–1901	L. Fréchette, C.M.G., LL.D.
1901–1902	James Loudon, LL.D.
1902–1903	Sir J. A. Grant, M.D., K.C.M.G.
1903–1904	Col. G. T. Denison, B.C.L.
1904–1905	Benjamin Sulte, Litt. D.
1905–1906	Dr. Alex. Johnson.
1906–1907	Dr. Wm. Saunders, C.M.G.
1907–1908	Dr. S. E. Dawson, C.M.G.
1908–1909	Dr. J. Edmond Roy.
1909–1910	Rev. Geo. Bryce, LL.D.
1910–1911	R. Ramsay Wright, M.A., B.Sc.
1911–1912	W. F. King, LL.D., C.M.G.
1912–1913	W. Dawson LeSueur, B.A., LL.D.
1913–1914	Frank D. Adams, Ph.D., F.R.S., F.G.S.
1914–1915	Sir Adolphe B. Routhier, Kt.

LIST OF ASSOCIATED SOCIETIES

Ontario.

Hamilton Association for the Promotion of Science, Literature and Art.
The Wellington Field Naturalists' Society.
The Hamilton Scientific Society.
L'Institut Canadien-Français d'Ottawa.
The Women's Wentworth Historical Society.
The Entomological Society of Ontario.
L'Institut Canadien d'Ottawa.
Women's Canadian Historical Society of Ottawa.
Elgin Historical and Scientific Institute.
Women's Auxiliary of the Elgin Historical and Scientific Institute.
Ontario Historical Society.
The Huron Institute.
Niagara Historical Society.
The Ottawa Field Naturalists' Club.
Royal Astronomical Society of Canada.
Canadian Institute, Toronto.
Historical Society, Kingston.
Toronto Astronomical Society.
Lundy's Lane Historical Society.
Women's Canadian Historical Society of Toronto.
United Empire Loyalists Association of Canada.
Peterborough Historical Society.
Canadian Forestry Association.
Hamilton Ladies' College Alumnae.
Club Littéraire Canadien-Français d'Ottawa.

Quebec.

Société du Parler Français au Canada, Québec.
Société de Géographie de Québec.
Société d'Economie Sociale et Politique de Québec.
The Quebec Society for the Protection of Plants from Insects and Fungus Diseases.
The Antiquarian and Numismatic Society of Montreal.
L'Institut Canadien de Québec.
Natural History Society of Montreal.
Microscopical Society, Montreal.

Société Historique, Montréal.
Cercle Littéraire de Montréal.
Literary and Historical Society, Quebec.

British Columbia.

The Natural History Society of British Columbia.
The British Columbia Academy of Science.

Nova Scotia.

The Nova Scotia Historical Society.
The Nova Scotia Institute of Science.

Manitoba.

Manitoba Historical and Scientific Society.

New Brunswick.

New Brunswick Historical Society.
New Brunswick Loyalists' Society.
Natural History Association.
Natural History Society of New Brunswick.

Prince Edward Island.

Natural History and Antiquarian Society of Prince Edward Island.

THE ROYAL SOCIETY OF CANADA

PROCEEDINGS FOR 1914

THIRTY-THIRD GENERAL MEETING

SESSION I.—(Tuesday, May 26).

The Royal Society of Canada held its thirty-third annual meeting in the New Medical Building, McGill University, and in Laval University; the sessions of May 26 and 28 being held in the former and those of May 27 in the latter. The Presidential Address was delivered in the Assembly Room of the New Medical Building, McGill University; and the Popular Addresses in the Assembly Hall of the Royal Victoria College.

The President, Dr. Frank D. Adams, took the chair at 10 a.m., and having called the meeting to order requested the Honorary Secretary to call the roll.

The following members answered to their names or arrived later during the session:—

Officers of the Society.

President, Dr. Frank D. Adams.
Honorary Secretary, Mr. Duncan C. Scott.
Honorary Treasurer, Mr. Lawrence M. Lambe.
Honorary Librarian, Mr. D. B. Dowling.

Section I.—Chapais, Thomas; Choquette, Ernest; DeCelles, A. D.; de Montigny, L. T.; Gérin, Léon; Gosselin, Mgr. Am.-E. Mignault, Pierre-Basile; Montpetit, Edouard; Myrand, Ernest; Poirier, Pascal; Rivard, Adjutor; Roy, Pierre-Georges; Sulte, Benjamin.

Section II.—Coyne, J. H.; Eaton, A. W. H.; Hill-Tout, Charles; Jones, Rev. Arthur E.; LeSueur, W. D.; Lighthall, W. D.; Longley, J. W.; McLachlan, R. Wallace; Raymond, W. O.; Scott, Duncan C.; Scott, Frederick George; Shortt, Adam.

Section III.—Allan, F. B.; Baker, Alfred; Barnes, H. T.; Burton, E. F.; Dawson, W. Bell; Eve, A.S.; Girdwood, G. P.; Harkness, James; Herdt, Louis A.; King, W. F.; Klotz, Otto; McLennan, J. C.; McLeod, C. H.; Plaskett, J. S.; Ruttan, R. F.; Shutt, F. T.; Stupart, R. F.

Section IV.—Adams, Frank D.; Bailey, L. W.; Barlow, A. E.; Buller, A. H. R.; Dowling, D. B.; Faribault, E. R.; Grant, Sir James; Harrison, F. C.; Hewitt, C. Gordon; Knight, A. P.; Lambe, L. M.; Macallum, A. B.; Mackay, A. H.; MacKenzie, J. J.; McInnes, Wm.; Matthew, G. F.; Miller, W. G.; Nicholls, A. G.; Roddick, T. G.

Letters of regret for absence were received from: Routhier, Sir Adolphe; Paquet, Mgr Louis A.; Bryce, Geo.; Tyrrell, J. B.; Burpee, L. J.; Denison, G. I.; James, C. C.; Brock, R. W.; Stansfield, A.; King, W. L. MacKenzie; Macphail, Andrew; Wrong, Geo. M.; Burgess, T. J. W.; Bell, Robert; Tory, H. M.

It was moved by Dr. A. H. R. Buller, seconded by Dr. J. S. Plaskett, that the minutes of the annual meeting of last year, as contained in the printed Proceedings of last year in the hands of the members, be confirmed.—Carried.

The Annual Report of Council, printed copies of which had been delivered to the members, was then presented by the Honorary Secretary. The Report was as follows:—

REPORT OF COUNCIL

FOR THE YEAR 1914-1915

To the Fellows of The Royal Society of Canada

The Council have the honour to present the following report on the work of the Society during the past year.

The last annual meeting was one of the most successful on record. The attendance was larger than usual and the interest manifested throughout the session was most gratifying. The Proceedings and Transactions which are now in your hands submit a record of the business transacted. The papers accepted for publication were of a varied character and well sustain the standard set by our previous volumes. The address delivered by the President and the Popular Lecture drew large and interested audiences, and the discussions in the Sectional meetings were interesting and important.

It was decided by the Council to call the Annual Meeting of the Society this year in Montreal. The Society had been honoured by the invitations of McGill University and Laval University, and the time seemed opportune for a meeting in the Province of Quebec as both our President and Vice-President are residents of the Province. The hospitality which will be extended to us on this occasion will be most heartily appreciated by the Fellows in attendance.

JOHN DOUGLAS SUTHERLAND

9TH DUKE OF ARGYLL, K G, P C, K T.

1845-1914

[illegible] THE [illegible]

I.—Proceedings and Transactions of the Society.

The current volume which is now ready for distribution, consists of 992 pages with accompanying illustrations. The usual edition (1260) has been printed and 5400 copies of separate papers have been supplied gratuitously to the authors. The agenda for the present meeting contains a full list of papers for discussion from which a selection will be made for publication.

II.—Election of New Members.

This year there are vacancies in all the Sections and as usual the voting was closed on the 1st April. The Council have much pleasure in reporting that the following candidates received a majority of the votes cast and their election is submitted for confirmation.

Section I.

Hon. Dr. Ernest Choquette.
M. Edouard Montpetit, B.A., LL.D.

Section II.

James Mavor, Ph.D.
William Peterson, C.M.G., LL.D.

Section III.

Francis Barclay Allan, M.A., Ph.D.
F. M. G. Johnson, M.Sc., Ph.D., F.I.C.

Section IV.

Thomas G. Roddick, M.D., C.M.

III.—Deceased Members.

It is with profound regret that we record the death of our founder, His Grace the Duke of Argyll, who died on May 2nd. The Council will consider an appropriate memorial in our Proceedings for the year. It may here be said that the inception of the Society arose

from a desire on the part of the late Duke to collect the scientific and literary forces of the Dominion, to organize them into a body which would stand for progress in letters and science and maintain high ideals in these branches of intellectual effort. Absence from the country after the close of his term of office as Governor General did not diminish his interest in our progress; our volumes were always promptly acknowledged; His Grace frequently communicated with the officers, and his pleasure in our stability and growing strength was cordially expressed.

The Society has also to lament the death of both our Honorary Vice-Presidents, the Right Honourable Lord Strathcona and Mount Royal, and Sir John Murray. The latter had just been elected Honorary Vice President and it would have been our pleasure to publish his letter of acceptance with the hope that his association with the Society would have been a long one. It is with very great regret that we now print the letter with the knowledge that his connection with the Society was short lived.

Challenger Lodge,
Wardie, Edinburgh.
16th August, 1913.

DEAR SIR,

I have to-day received your letter of the 18th July in which you intimate that The Royal Society of Canada, in general meeting, has done me the very high honour of electing me an Honorary Vice-President of the Society.

I have much pleasure in accepting the election and I ask you to assure the Fellows and Officers of the Society that I could not appreciate any honour more highly than this recognition of my scientific work and of my connection with Canada on behalf of the representative Scientific Society of my native country.

I shall be very pleased if I can at any time render any services to the Society.

Yours sincerely,
JOHN MURRAY.

FRANK DAWSON ADAMS, Esq.,
President of
The Royal Society of Canada.

In the ranks of the Fellows three vacancies have occurred by death: Dr. Henry J. Morgan, Mgr. T.-E. Hamel, and Dr. Nathaniel Alcock. Biographical notices of the late Fellows appear herewith.

MGR THOMAS-ETIENNE HAMEL

Dr. John Reade, F.R.S.C. of Montreal contributed the notice of Dr. Morgan, Mgr. A. E. Gosselin is the author of the notice of Mgr. Hamel and Dr. Adami supplied that of Dr. Alcock.

(1).—Monseigneur Thomas-Etienne Hamel.

Monseigneur Thomas-Etienne Hamel, Licencié-ès-Sciences, Protonotaire Apostolique, Vicaire Général de l'archidiocèse de Québec, ancien recteur de l'Université Laval, est décédé au Séminaire de Québec le 16 Juillet 1913, dans la 83me année de son âge et la soixantième de son sacerdoce.

Mgr Hamel fut l'un des membres fondateurs de la Société Royale du Canada dont il a été le cinquième président général en 1886-1887. Il appartenait à la IIIe section, dite des sciences, de mathématiques, de physique et de chimie. Il n'est donc que juste que nous lui consacrions ici une courte notice biographique.

Né à Québec le 28 décembre 1830, Thomas Hamel fit ses études classiques au petit séminaire de sa ville natale.

A l'automne de 1849, il entrait au Grand Séminaire pour y étudier la théologie et s'y préparer à la prêtrise qu'il reçut le 8 janvier 1854. Durant ces quatre années, il avait rempli tour à tour ou simultanément les charges les plus diverses comme celles de maître de discipline, de professeur de langues, de mathématiques, de physique, d'assistant-directeur des élèves, etc. C'est dire quel vaste champ pouvaient embrasser son activité intellectuelle et ses forces physiques.

L'Université Laval venait d'être fondée. Le Séminaire de Québec, qui s'était chargé de cette lourde tâche, n'eut rien plus à cœur que de fournir à la nouvelle institution, et aussitôt que possible, des professeurs compétents. Les anciens maîtres de Thomas Hamel trouvèrent en lui toutes les qualités désirables: talents faciles, amour du travail, santé robuste. Il fut donc désigné pour aller à Paris étudier les sciences et plus particulièrement les mathématiques et la physique. Son séjour à l'Ecole des Carmes dura quatre années, et, en 1858, l'abbé Hamel revenait à Québec avec son diplôme de Licencié-ès-Sciences. Entre-temps, il avait suivi les cours de diction et de déclamation du célèbre Delsarte qui garda toujours le meilleur souvenir de son ancien élève.

L'année qui suivit son retour, l'abbé Hamel fut chargé des cours de physique, de minéralogie et de géologie. Professeur de physique à l'université, il y enseigna cette science jusqu'en 1874. Il y donna aussi les cours d'astronomie de 1859 à 1866.

Le 24 février 1871, M. Hamel fut nommé supérieur du séminaire de Québec et recteur de l'université Laval à la place de M. E.-A.

Taschereau, créé archevêque de Québec. Il occupa ce poste et sans interruption jusqu'en 1880 tout en remplissant par intervalles les fonctions de professeur, soit au petit, soit au grand séminaire. Ce fut aussi l'époque où l'Université Laval eut à faire face à toutes sortes de difficultés. M. Hamel suffit à tout.

Après avoir été directeur du grand séminaire pendant quelque temps, M. Hamel réassuma pour trois ans—1883-1886—ses anciennes fonctions de supérieur du séminaire et de recteur de l'université dont il fut ensuite le bibliothécaire, de 1886 à 1908. C'est alors que ses infirmités, en particulier sa vue défectueuse, le forcèrent à abandonner tout travail. Il y avait cinquante ans qu'il se dépensait sans compter au service du séminaire de Québec et de l'université Laval.

L'Archevêque de Québec, Mgr E.-A. Taschereau, l'avait nommé Vicaire Général de l'archidiocèse en 1871 et, en 1886, S. S. le Pape Léon XIII l'élevait à la dignité de Protonotaire Apostolique.

Mgr Hamel a été le type achevé du prêtre éducateur. Nul n'a plus ni mieux travaillé que lui pour le bien de la jeunesse étudiante. Nul n'a plus aimé ni mieux servi le séminaire de Québec et l'université Laval dont il restera l'une des gloires les plus pures.

Doué de talents supérieurs, d'une activité illassable, d'une force de résistance peu commune, Mgr Hamel a pu suffire, durant de longues années, à des tâches aussi difficiles que disparates. Un dévouement sans bornes et une santé à toute épreuve peuvent seuls expliquer comment parfois il n'a pas fléchi sous le fardeau.

Grâce à son rare bon sens, à son coup d'œil juste, à son admirable droiture, Mgr Hamel fut un bon administrateur. Il a pu et dû se tromper puisqu'il était homme, mais sa bonne foi ne pouvait être mise en doute. Que si parfois il surprenait par la brusquerie de ses manières ou encore par ses affirmations aussi énergiques qu'absolues, on s'apercevait bien vite qu'il n'y avait pas un homme moins entêté et que son cœur recélait des trésors de tendresse. Les petits, les affligés, les pauvres surtout ont souvent fait l'expérience de sa bonté et de sa charité.

Avec sa science étendue, son esprit clair et méthodique, sa diction soignée et sa mimique si vivante, Mgr Hamel aurait pu être un professeur idéal s'il n'avait pas trop oublié peut-être qu'il parlait à des jeunes gens à qui les examens du baccalauréat laissaient peu de temps pour les longueurs et les abstractions.

Mgr Hamel avait fait de fortes études à Paris et sa réputation d'homme de science était si bien établie dans notre province, qu'il fut choisi, en 1882, comme l'un des membres fondateurs de la Société Royale du Canada.

HENRY JOHN MORGAN

Sans doute, Mgr Hamel a peu écrit; les fonctions graves et multiples qu'il eut à remplir, le mauvais état de sa vue, et peut-être aussi une répulsion marquée pour la publicité, l'ont empêché de se livrer à des travaux de science ou de littérature et de faire bénéficier ses concitoyens de ses connaissances nombreuses et variées. Cependant, les discours qu'en sa qualité de président de sa Section ou de président général de la Société il a dû adresser à ses collègues, ainsi que les quelques articles qu'il a fait paraître dans des journaux ou des revues, montrent jusqu'a quel point il avait l'esprit scientifique.

A part ses travaux manuscrits—notes de cours comprenant huit ou dix gros cahiers—Mgr Hamel a laissé deux volumes: *Le Premier Cardinal Canadien* et son *Cours d'Eloquence parlée* d'après Delsarte, en 1906.

Cette courte notice biographique est loin de rendre justice à l'homme éminent que fut Mgr Hamel. Il aurait fallu parler du prêtre vertueux et zélé, du confrère aimable et complaisant, du citoyen dévoué et charitable que tant de générations d'étudiants, de prêtres et de laïques ont connu, aimé et vénéré. Il aurait fallu parler aussi de ses dernières années; de son effacement, de son amour de la règle, de son inaltérable patience. Mais le temps et l'espace nous font défaut.

La Société Royale du Canada devait cet hommage à la mémoire de l'un de ses membres fondateurs les plus respectés, et ses anciens collègues qui se sont déjà associés aux regrets qu'ont éprouvés, en apprenant sa mort, les amis et les connaissances de Mgr Hamel, garderont fidèlement son souvenir.

(2.)—Henry John Morgan.

By the death of Dr. Morgan, which took place at his daughter's residence in Brockville, Ont., on the 27th of December, 1913, The Royal Society of Canada has lost one of its most active and most esteemed members. Henry John Morgan, the son of one of Wellington's veterans who came to Canada in 1838 with the Brigade of Guards, was born on the 14th of November, 1842, at Quebec, was educated at Morrin College in the same city, and entered the public service during the administration of the eighth Earl of Elgin. He won and retained the confidence of his superiors and rose steadily in official position till he became Keeper of the Records and Chief Clerk in the Department of State. In 1873 he was instructed to remove from Montreal to Ottawa the historical documents that had for years been lying in the vaults of the old Government House, better known to-day as the Chateau de Ramezay. The manuscripts then transferred to the Dominion capital are now comprised in the great collec-

tion of Archives, under the control of Dr. Doughty. Dr. Morgan's official career lasted until 1895, when after forty-two years of service, he retired on a pension.

Dr. Morgan was a barrister both of Quebec and Ontario. He was a Fellow of the Royal Society of Northern Antiquaries and an honorary Fellow of the Royal Colonial Institute. Among the academic distinctions with which he was favoured were M.A. of Amherst, Mass. (1881); LL.D., University of Ottawa (1903); D.C.L., King's College, Windsor, N.S. (1905). Among Dr. Morgan's public services volunteers will not forget that it was he who originated the idea of the long service medal. His relation to the principles and organization of the Canada First movement is mentioned with honour by Dr. Goldwin Smith in his Introduction to "Canada First: A Memorial of the late William A. Foster, Q.C." And in the Prefatory Note his name is linked with the names of Dr. Smith and Mr. Mercer Adam as those of persons to whom the writer (M. B. F.) is specially indebted. In the same volume is reproduced from the Ottawa Citizen Dr. Morgan's review of Mr. Foster's career.

Dr. Morgan married in 1873 Miss Emily Richards, second daughter of the late Hon. A. N. Richards, Q.C. Mrs. Morgan died in 1901.

Dr. Morgan's contribution to letters took mainly the form of biography and it is all valuable. To his wise thoughtfulness we owe that record of "The Tour of H.R.H. the Prince of Wales in Canada and the United States," without the aid of which no complete life of King Edward the Seventh can be compiled. In 1862 he published "Sketches of Celebrated Canadians and Persons connected with Canada from the Earliest Period in the History of the Province down to the Present Time"—a book that grows more precious every year. In 1898 appeared a work which has made Dr. Morgan's name known in every quarter of the globe—"Canadian Men and Women of the Time"—and in 1912 he brought out a second and greatly enlarged edition. This work is a monument to Dr. Morgan's conscientious and painstaking industry. He had, indeed, a genius for contemporary biography, and he cultivated it in the most happy and fruitful way. "Hardly a day passes," wrote a grateful journalist, "in which we do not refer to some of Dr. Morgan's various stores of information and rarely do we refer to them in vain." Another work of research, equally deep and wide, and of more delicate note is the "Types of Canadian Women and of Women who are or have been Connected with Canada." The theme is fascinating but we must resist the siren spell. The "Bibliotheca Canadensis" appeared opportunely in 1867 and was dedicated to Sir John Macdonald. It is a "Manual of Canadian Literature" that is invaluable to the student as a book

NATHANIEL H. ALCOCK

reference. In the Bibliotheca Canadensis, Celebrated Canadians and Types of Canadian Women, Dr. Morgan was a pioneer and, in every case, a successful pioneer.

Among the most important of Mr. Morgan's serial publications were the Canadian Parliamentary Companion, established in 1862; the Dominion Annual Register, started in 1878 and the Canadian Legal Directory: a Guide to the Bench and Bar of the Dominion, issued in 1878. A work of very real interest entitled Canadian Life in Town and Country was written by Dr. Morgan in collaboration with Mr. L. J. Burpee, F.R.G.S. In 1865 Dr. Morgan edited the speeches and addresses of the Hon. Thomas D'Arcy McGee, and in the same year published a lecture on The Place that British Americans have won in History. Dr. Morgan had hosts of friends, and with him death did not sever the ties of friendship. How he commemorated Nicholas Flood Davin, Pierce Stevens Hamilton, Robert Grant Haliburton, the Very Reverend Æneas Macdonell Dawson, V.G., and others whom in life he had esteemed and loved some of his colleagues are not likely to have forgotten.

(3).—Nathaniel H. Alcock.

Nathaniel Henry Alcock, late Professor of Physiology, McGill University, was born in 1871, the son of Dr. D. R. Alcock, Staff Surgeon in the Navy. He came of good north of Ireland stock, his uncle, the Rev. T. K. Abbott, D.D., Litt.D., being Senior Fellow of Trinity College, Dublin, and to Trinity College he went, there graduating in Arts and Medicine. He gained numerous distinctions in his undergraduate career, including the Senior Moderatorship and the Gold Medal in Natural Sciences.

Soon after graduating as M.D. in 1896, he was appointed Demonstrator of Anatomy at Owens College, Manchester, and the following year returned to Dublin as assistant to the King's Professor of Institutes of Medicine (Physiology and Histology) at Trinity College and the Royal College of Physicians, Dublin, remaining there until 1902, when he went over to the University of Marburg to undertake work under Professor Meyer in pharmacology, the Marburg laboratory at that period being one of the most active centres of original investigation in Europe. In 1903 he was appointed Demonstrator of Physiology in the University of London, under Professor Waller, in conjunction with whom he undertook several researches of first class importance on Chloroform and other anæsthethics. As those who were present at the meeting of the British Medical Association in Montreal in 1897 will recall, these are investigations in which Pro-

fessor Waller has been engaged for long years. Dr. Alcock's studies in Marburg prepared him in a very material way to undertake work which is on the border line between Pharmacology and Physiology.

These investigations resulted in the development by Dr. Alcock of apparatus by which chloroform can be administered with the greatest precision, the chloroform being carefully and almost automatically graduated. Alcock's apparatus and modifications of the same are in use in the operating theatres of not a few hospitals. His method constituted a distinct advance upon any previous.

This work with Professor Waller led to Dr. Alcock being appointed Lecturer in Physiology at St. Mary's Hospital Medical School, a position previously occupied by his senior. Here he remained from 1905 to 1911. St. Mary's is one of the smaller medical schools in London, but for long years has boasted a series of distinguished men upon its staff. Since the beginning of this century it has seen a period of great activity, and has come to the fore, largely owing to the researches upon Opsonins carried on in its pathological laboratory by Sir Almroth Wright, which have resulted in graduate students flocking there from all parts. Dr. Alcock threw himself into the work of the Medical School proper, rapidly gaining a reputation as an admirable teacher who kept before him constantly the facts that he was training those destined to be medical practitioners, and that as good results can be obtained by employing apparatus and instruments of precision which will be used daily by the student in his future career, and studying phenomena which will constantly present themselves in the patient, as can be gained from instruments and processes which have little direct bearing upon the future life work of the taught. From a practical point of view there could be no question as to the advantage of thoroughly grounding students in those branches of Physiology that have a direct practical application. We know of no textbook connected with Physiological laboratory work that is more excellent for the medical student than that published by him in conjunction with Mr. F. O'B. Ellison.

During these years at St. Mary's Dr. Alcock was a man of intense energy and wide interests. His breadth was well manifested by the high level obtained by that admirable quarterly "Science Progress," of which he was first editor. As a matter of fact he ranged widely in his studies. A monograph upon Irish Bats was one of his first contributions to science, and he was a keen astronomer, making his own silver-on-glass-mirrors. His interest in everything connected with the Medical School led to his appointment as Sub-Dean, and rapidly he came to be regarded as representative of the smaller London Medical Schools, fighting the battle for their due

recognition with very considerable success. Throughout the stirring debates which marked the re-constitution of the University of London, his north of Ireland blood led him to rejoice in a good fight, nor is it an exaggeration to say that he delighted to dangle his coat tails on the ground and have someone step upon them. There was a quizzical twinkle of his eye on these occasions that evinced his thorough enjoyment of the situation.

One move due to Dr. Alcock's initiative has had results of which probably he little dreamed. As Dr. W. H. Willcox puts it* "It was entirely through his devotion and energy that the Board of Education was induced to recognize medicine as a branch of science entitled to a Government grant for assistance in its teaching, and St. Mary's was the first Medical School in England to receive a grant from the Board." The other London Medical Schools speedily followed its example. The result has been that giving this assistance, the Board of Education has claimed the right to enquire into their facilities and has—we think wisely—made its grant conditional upon thorough equipment and training, with the result that under this active supervision medical education in London is assuming a better and healthier state.

In 1905 Dr. Alcock married Nora, daughter of the late Sir John Scott, K.C.M.G., Financial Adviser to the Khedive. In 1909 he was granted the degree of D.Sc. of London University for his researches upon the influence of anæsthetics upon nervous phenomena. In 1911 he was appointed to the Chair of Physiology at McGill University in succession to Professor Wesley Mills who had resigned on account of ill-health. While Dr. Alcock thoroughly enjoyed the strain and turmoil of his life in London, it proved too much for him, and the needs and future of his little family of four, led him to accept the invitation to come to Canada. He was, indeed, already suffering from the disease which brought his life to an untimely end, and it was with the hope that complete change to a fresh and more invigorating atmosphere might arrest his malady that he came to Canada. As a matter of fact the change had the desired result; his condition rapidly improved, and he found himself better and stronger in every respect during the first year, throwing himself heartily into the reorganization of his laboratory and the teaching of his subject. But a most unfortunate accident occurred in the summer of 1912, when spending his vacation in the Laurentians to the north of Montreal. While climbing a mountain in the attempt to stave off a large boulder which had become dislodged, his left hand was crushed and several fingers were hopelessly damaged, so that

*St. Mary's Hospital Gazette, June 1913.

they had to be amputated. The hemmorrhage and shock of this accident proved the turning point. His disease lighted up again, and steadily progressed to the fatal termination upon June 13th 1913.

Dr. Alcock was a genial companion, with a well-marked sense of humor and an alert mind, combining the combativeness of the north with that debonair attitude towards life which we are so accustomed to associate with the south of Ireland. His bravery was well shown by the gallant fight he put up against his illness up to the very last moment, in which he was ably supported by his devoted wife.

Dying at the age of forty-two, a college professor has little opportunity to provide for his widow and small family. Dr. Alcock's friends in England and Canada have raised a fund of £3000 towards the education of the four children, while recognizing his services to Education in England Mr. Asquith has afforded Mrs. Alcock a pension out of the Civil Service Fund.

Among his more important contributions to scientific literature may be mentioned researches upon electro-motive force of the negative variation of the vagus and other nerves under the respiration stimulus (in Pflüger's Archiv); upon fatigue in nerve and the velocity of the nervous impulse in tall and short people (Proceedings of the Royal Society, Vols. 73, 77, 78); numerous papers on the physical, chemical, and electrical properties of nerves (Journal of Physiology); chapters on the physiology of nerves ("in Further Advances in Physiology"); "The Accurate Dosage of Chloroform by means of a Regulating Inhaler" (already noted); articles upon "Muscarine," "Carpain", &c.; Textbook of Experimental Physiology, with F. O'B. Ellison, M.D., London, J. & A. Churchill, 1909.*

IV.—Poisonous Matches.

One of the most important subjects dealt with at our last annual meeting was the use of poisonous phosphorus in the manufacture of matches. A very large delegation from the Society waited on the Hon. Thomas Crothers, Minister of Labour, on Saturday November 22nd. The Minister gave the delegation a very attentive hearing and promised consideration. It is understood that a Bill has passed through Parliament to prevent the use of poisonous phosphorus in the manufacture of matches and will in due course become law. The

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*The main biographical details of this notice were obtained from the British Medical Journal and the St. Mary's Hospital Gazette.

Government is to be congratulated, as the result should be the elimination from this trade of elements highly dangerous to human life.

V.—Permanent Quarters for the Society.

At the last annual meeting a discussion took place and a resolution was passed dealing with permanent quarters for the Society. An influential delegation waited on the Minister of Public Works on the 7th January. Hon. Mr. Rogers received the deputation with cordiality, and it is probable that before very long the Society will find itself in possession of accommodation in one of the public buildings in Ottawa which may be considered as headquarters for the future.

VI.—The National Library.

The views of the Society, as expressed by the resolution passed at the last annual meeting, were laid before the Government on the 16th July last. A copy of the memorial follows. This important question will no doubt receive the serious attention of the Government.

Ottawa, July 16, 1913.

To His Excellency
The Administrator in Council:—

The undersigned has the honour to state that at the late meeting of The Royal Society of Canada in May, last, the following resolution respecting the establishment of a National Library for Canada was unanimously approved:—

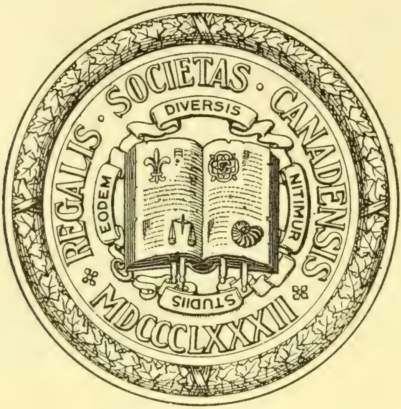
"That this Society, recognizing the vital importance to any civilized people of a National Library, organized and maintained upon broad and efficient lines, and particularly to a young, rapidly growing, and ambitious community such as ours; and also recognizing its great usefulness to students in every branch of human knowledge, its practical and economic worth as a general repository of information, now scattered in many libraries, or inaccessible, and its value as a rallying point for the library activities of the whole community;—respectfully urges upon the consideration of the Dominion Government the early establishment of such an institution for the general benefit of the people of Canada."

The undersigned on behalf of The Royal Society of Canada would respectfully request favourable consideration of the subject matter of this resolution.

Frank D. Adams, *President.*

VII.—The Seal of the Society.

- A print of the Seal as accepted by correspondence following the permission given by the Society at the last general meeting, is presented herewith.



VIII.—Method of Publication.

Probably the most important subject to be discussed at the present meeting is the proposed alteration in the method of publishing the Transactions of the Society. A circular was issued by the Honorary Secretary dated the 1st April, in which the new proposals are outlined. A copy of the circular follows, and the Council would claim for these important proposals your very careful consideration.

At the last Annual Meeting of the Society one of the most important questions discussed was the policy which should be followed n the expenditure of the increased grant which has been placed at our disposal by the Government. Each of the Sections, with the exception of Section I, reported to the general meeting as follows:—

Section II.—Regarding the expenditure of the additional government grant the Section recommends that, as the subject requires much consideration, the matter be entrusted to the Council, with request to seek the views of every Fellow of the Society by correspondence or personally.

Section III.—The question of the most desirable use of the surplus funds referred to in Section XIII of the Report of Council was very fully discussed by the Section and it was decided to make the following recommendations:—

1.—That the major portion of the money available be devoted to the encouragement of research.

2.—That a medal be awarded at intervals and only in recognition of scientific or literary work of very exceptional merit.

Section IV.—The Section unanimously passed the following resolutions:—

1.—That Section IV recommend to the Council that two medals be awarded from time to time, one in literature and one in science, alternately, on the recommendations of Sections I and II and III and IV respectively, the said medals to be called The Royal Society of Canada medals. These medals to be awarded for work accomplished in Canada, and that the recipient need not necessarily be a Fellow of the Society.

2.—That the Council be requested to consider the possibility of voting grants in aid of scientific research.

3.—That the Council be requested to consider whether additional facilities cannot be provided by The Royal Society of Canada for the more extended and rapid publications of the results of investigations carried on in the Dominion of Canada.

The Council has given this matter very careful consideration since the adjournment of the May meeting. It will be observed that Sections III and IV agree upon the foundation of a medal and financial assistance in the way of grants to aid scientific research. Section II entrusted the question to Council requesting that the views of every Fellow of the Society be sought by correspondence or personally. The request of Section II has been complied with so far as the careful consideration of the Council is concerned, and in pursuance of the second recommendation the conclusions arrived at are now laid before you for expression of your views either by correspondence with the Honorary Secretary or by discussion at the approaching annual meeting.

The question as it presented itself to Council was "How can the usefulness of the Society be increased and in what manner can the Society best promote the progress of literature and science by the expenditure of our funds." Upon the close consideration of the needs of literary and of scientific workers in Canada, it became apparent that what was greatly needed was a medium of immediate publication for literary and scientific papers. As you are well aware the present method of publication is slow; a twelve-month or more elapses between the acceptance of the paper and its appearance in print. Council has, therefore, concluded to recommend a radical alteration in in the method of publishing the Transactions. The following is an outline of the proposed changes.

The publications of the Society now consist of the Proceedings and the Transactions. The Proceedings which contain the record of the business of the annual meeting with appendices will continue to be published once a year as soon as possible after the close of the annual meeting. The Transactions will be published quarterly; the papers of each Section will be issued as a separate series. Sections I and II may decide to combine and issue a quarterly literary series.

The present printing committee of each Section shall be an Editorial Board for the Section, one of the members being selected

as Editor. It will be his duty to present to the Honorary Secretary, who will continue to manage the general business of publishing, the matter for the quarterly parts of the Transactions consisting of such papers as have been approved by the Editorial Board: papers by non-members, when presented by Fellows, would be accepted: papers would be accepted in addition to those presented at the annual or other meetings of the Society.

The advantages of the suggested method of publication are as follows:—

1. The more prompt publication of papers would be secured.

2. A medium for the publication of papers by Canadian writers would be provided. This and the previous object would serve to encourage the publication by Fellows and others in the Society's Transactions of papers which at present are sent to journals in other countries owing to the delay in publication under present conditions. The Transactions would thereby reflect to a far greater degree the progress of literary and scientific work in Canada.

3. Memoirs published in the Transactions would secure a wider circle of readers as a result of the regular quarterly appearance of the Transactions in the libraries and elsewhere and also by the opportunity which would be afforded to special institutions and individuals of subscribing to separate series. This would be of inestimable advantage to Canadian investigators.

4. The reputation of the Society would be enhanced and the work of its Fellows and other Canadian investigators would be more widely known.

5. In the case of the scientific sections priority would be more readily secured. Under present conditions it is almost impossible to secure such priority.

The improvements proposed would increase the cost of the publications and the expenditure for distribution and clerical services would necessarily be somewhat higher.

As the main question which occupied the attention of Council was how the usefulness of the Society could be increased, the question of the foundation of a medal has been left in abeyance. It is thought that after the cost of the quarterly publication has been met and the necessary expenditure upon the library, that the Society would have from time to time funds available to encourage research work in a modest way.

IX.—The International Geological Congress.

The International Geological Congress, on the invitation of the Dominion Government, the Ontario Government, The Royal Society of Canada and the Canadian Mining Institute, held its XIIth session in Canada in 1913, and, in doing so, emphasized the growing coherence of the eastern world with the west in scientific thought and endeavour. The coming of the Congress to Canada was an event of paramount importance in the realm of science.

The Congress convened in Toronto on August 7th, at which time the monograph, prepared by Messrs. McInnes, Dowling and Leach, of the Geological Survey of Canada, on the Coal Resources of the World, was presented. This monograph, consisting of 1266 pages in three volumes, with an atlas of 48 maps, is a notable addition to the literature on the subject and is comparable with the "Iron Ore Resources of the World" of the XIth session held at Stockholm in 1910.

Meetings were held for the discussion of papers of general interest, as well as meetings of sections as follows: Section 1. (*a*) Pre-Cambrian, (*b*) Economic, (*c*) Petrology, Mineralogy, etc.; Section 2. Palæontology and Stratigraphy; Section 3. Glacial Geology and Physiography, and a special Section for Tectonics and miscellaneous papers.

Previous to the meeting in Toronto a number of excursions were made in the eastern part of the Dominion to mining centres and places of geological interest in eastern Ontario, Quebec and the maritime provinces. During the meeting a number of short excursions took place to various localities in the neighbourhood of Toronto. After the meeting there were separate excursions to the Pacific coast, one by Crow's Nest Pass and another through the Kicking Horse Pass, followed by one to the Yukon. Subordinate excursions were also held in the west to notable mining areas.

These excursions, as in former meetings of the Congress, formed a prominent feature of the session; they were largely attended and were entered into with the greatest enthusiasm and interest.

The great benefit derived by the members from the mutual interchange of ideas cannot be overestimated. The vast natural resources of the Dominion were prominently before them in all sections of the immense territory covered and cannot fail to have left a favourable and lasting impression on all who were present.

X.—Purchase of a Large Telescope for the Dominion Observatory.

After consultation with a number of astronomers and instrument designers in the United States and Europe, specifications were drawn for the construction of reflecting telescopes with principal mirrors of 60 and 72 inches aperture respectively, and a number of instrument makers were invited to tender on each size, separate tenders being asked for the mounting and the optical parts.

When the tenders were received the Government decided in favor of the larger size, and authorized contracts with the Warner and Swasey Company, of Cleveland, Ohio, for the construction of the mounting and with the John A. Brashear Company, of Pittsburg,

Pennsylvania, for the construction of the optical parts. Both of these firms have had much experience in the construction of large astronomical instruments and are of high reputation for care and skill. The amount of the two contracts is $90,750.00.

This telescope, 6 feet in aperture, will be larger than any telescope now in use, equalling in size the celebrated telescope constructed by Lord Rosse seventy years ago, but superior to that in having the modern equatorial mounting.

Much information as to atmospheric conditions in relation to astronomical observations at several places in Canada was procured. It has been found that a site a few miles from the city of Victoria, British Columbia, offers the most suitable conditions, in regard to steadiness of the atmosphere, transparency and low range of temperature. Land has been purchased, and the building will be proceeded with before long.

XI.—The Establishment of Research Stations.

While the Government has not yet seen fit to accede to the recommendation, made by the Council in their memorial of the 17th October 1912, that research stations, provided with wireless telegraphic outfit, be established, at points in northern Canada, a certain measure of advance may be reported. Steps are being taken in the direction of one of the most important of the uses of wireless telegraphy set forth in the memorial; namely, its application to surveys through the determination of longitude.

Experiments are now in progress at the Dominion Astronomical Observatory to ascertain the possibility of receiving, with portable receiving apparatus, clock signals sent out by some of the existing wireless stations of the Naval Service.

If these preliminary experiments indicate the practicability of the plan, it is proposed to send an observer, provided with receiving apparatus, to several points on the upper Ottawa River, to determine the longitudes, and thereby to provide reference points for the survey of that region.

It is anticipated that success in this attempt, if achieved, with the great saving of expense which it would effect, will lead to an extensive use of this method in the more remote parts of Canada, and ultimately to the adoption, in full measure, of the recommendations of the memorial.

XII.—Finances of the Society.

The Honorary Treasurer's statement of Receipts and Expenditure is appended. This is furnished under two heads of Government

Grant Account and General Account, and has been duly audited by two members of the Society, Dr. Adam Shortt and Dr. J. C. Glashan, appointed by the Council for that purpose.

STATEMENT OF RECEIPTS AND EXPENDITURE OF THE ROYAL SOCIETY OF CANADA, FOR THE YEAR ENDING 30th APRIL, 1914

GOVERNMENT GRANT ACCOUNT

RECEIPTS

Balance in Bank of Montreal		$ 1,158.21
Grant from Dominion Government	$ 8,000.00	
Of which 1-6 received 28th April, 1913	1,333.33	
	$ 6,666.67	6,666.67
Bank interest on account		151.12
Foreign postal distribution, refund of balance		12.20
		$ 7,988.20

EXPENDITURE

Transactions, printing, binding, distribution, library, etc. (See appendix A)	$ 5,278.73
Balance in Bank of Montreal, 30th April, 1914	2,709.47
	$ 7,988.20

GENERAL ACCOUNT

RECEIPTS

Balance in Merchants Bank of Canada		$ 2,608.73
Membership fees, annual	$ 635.55	
Life membership fee; Wm. McInnes	50.00	
		685.55
Volumes of Transactions sold		82.00
Interest, Merchants Bank of Canada		70.00
" Standard Trusts Co. of Winnipeg		237.45
		$ 3,683.73

EXPENDITURE

Toward railway fares of members attending annual meeting, 1913	$ 611.80
Annual meeting, popular lecture, expenses of lecturer	46.55
Grant toward publication of Physical and Chemical Constants	50.15
Balance on hand, Merchants Bank of Canada, 30th April, 1914 (inclusive of life membership fund)	2,988.08
	$ 3,696.58
Less outstanding cheque	$ 12.85
	$ 3,683.73

LAWRENCE M. LAMBE,
Hon. Treasurer.

Audited and found correct.

ADAM SHORTT,
J. C. GLASHAN, } *Auditors.*

May 6th, 1914.

APPENDIX A.

STATEMENT IN DETAIL OF CHARGE IN GOVERNMENT GRANT ACCOUNT.

1913		
April	25—One Underwood typewriter for library, M. G. Bristow	$ 117.00
"	25—Hugh Carson Co., mail bags	3.50

1913		
May	1—Miss M. Sinclair, library, salary for month of April	35.00
"	1—Capital Press, circulars and envelopes	14.75
"	15—Floral wreath, occasion of funeral of J. Edmund Roy, F.R.S.C	10.00
"	15—Electric Transfer Co., cartage	3.00
"	30—Clerical services for months of March, April and May	50.00
"	30—Miss M. Sinclair, library, salary for month of May	35.00
"	30—Hon. Secretary, current expenses	15.00
June	4—James Hope & Sons, stationery	12.40
"	11—Proof reading, French, vol. VI of Transactions, 3rd Series	40.00
"	11—Electric Transfer Co., cartage	2.50
"	13—The Topley Co., setting up and operating two lanterns at Annual Meeting	14.00
"	17—Evening Citizen, advertising Annual Meeting	12.60
"	17—Evening Journal, advertising Annual Meeting	12.60
"	17—Ottawa Free Press, advertising Annual Meeting	12.60
"	18—Library Bureau of Canada, furniture, office books and stationery, etc., for library	95.00
"	23—The Topley Co., rental six covers for skylight at Public Library, Annual Meeting	4.00
"	23—Capital Press, envelopes	4.50
"	28—Miss M. Sinclair, library, salary for month of June	35.00
July	3—Foreign postal distribution of vol. VI of Transactions	110.00
Aug.	11—James Hope & Sons, stationery	9.00
"	11—Auditing of printing account of The Mortimer Co	15.00
"	11—The Mortimer Co., closing account for printing and binding vol. VI of Transactions	417.08
"	13—The Topley Co., negatives and prints of design for Royal Society of Canada seal	2.00
Sept.	22—Miss M. Sinclair, library, salary for months of July and August	70.00
"	24—Clerical services for months of June, July and August	60.00
Oct.	2—Miss M. Sinclair, library, salary for month of September	35.00
Nov.	7—Miss M. Sinclair, library, salary for month of October	35.00
"	15—Hon. Secretary, current expenses	10.00
"	15—The Electric Transfer Co., cartage	1.00
"	26—Clerical services for months of September, October and November	60.00
"	26—Miss M. Sinclair, library, salary for month of November	35.00
"	27—Pritchard & Andrews, rubber stamps	1.60
Dec.	22—Drawings for seal for Royal Society of Canada	25.00
"	29—Miss M. Sinclair, library, salary for month of December	35.00
1914		
Jan.	15—Capital Press Co., stationery	7.35
"	30—Miss M. Sinclair, library, salary for month of January	35.00
"	30—The Mortimer Co., interim account, printing vol. VII of Transactions	1,500.00
Feb.	5—Crown Lithographing Co., embossed envelopes	5.75
"	24—Clerical services for months of December, 1913, and January and February, 1914	60.00
March	4—Miss M. Sinclair, library, salary for month of February	35.00
"	24—John Robertson, cartage, and twelve months' storage of books (exchanges)	57.50
"	27—Miss M. Sinclair library, salary for month of March	35.00
April	2—Fire insurance (North British and Mercantile Ins. Co.) on Society's property (transactions) in Mortimer building, Ottawa, 5th April, 1914, to 5th April, 1915	24.00
"	8—Typewriting	10.00
"	8—Hon. Secretary, current expenses	10.00

April	22—The Mortimer Co., printing, etc., vol. VII of Transactions (on account)	2,000.00
"	28—Miss M. Sinclair, library, salary for month of April	50.00
		$5,278.73

LAWRENCE M. LAMBE,
Hon. Treasurer.

Audited and found correct.

ADAM SHORTT, J. C. GLASHAN, } *Auditors.*

May 6th, 1914.

XIII.—Report of the Honorary Librarian.

The various exchange publications received from other societies and institutions, owing to the previous lack of proper accommodation, had been securely packed each year and stored. This year, owing to the shelving and space allotted by the Minister of Public Works to the Society in the Victoria Museum, the accumulated material has nearly all been removed from the warehouse and unpacked at the Library. For aid in the manual labor of opening and handling the boxes our thanks are due to the Director of the Geological Survey for the co-operation of the museum assistants.

This material has been sorted out and arranged by Miss Sinclair, the Librarian, on whom will fall also the duty of making a catalogue and reference index.

There have been received at the Library during the year 77 boxes or cases, 27 mail bags and 9 parcels containing books. Of these about one thousand are bound books and of the remainder, unbound publications, many, probably over one-half, are separate reports grouped in volumes containing from 4 to 12 numbers. Of these volumes it is estimated there are seven thousand. An estimated eight thousand volumes is thus on the shelves, but, counting all the separate publications, the number would be double or treble. Many blue books and pamplets have not been enumerated, as their value for reference is doubtful. The Society has been receiving publications from about 630 different sources, mainly kindred societies and scientific institutions. Many of these have contributed since 1885, but, owing to various causes, there are many gaps in the sets of volumes which it may be possible still to have filled. This will have the earliest consideration and an index or catalogue of the Library prepared. At the present time it is possible to give only a general list of the sources from which the exchanges come and the number of volumes received. The preliminary list which is an estimate is as follows:—

165	Scientific Societies and University Publications Vols	3753
29	Observatories and Astronomical Societies	178
35	Natural History Museums	333
11	Scientific Expeditions	42
28	Geological Surveys	1347
29	Natural History Societies	201
15	Geological Societies	123
26	Historical Societies	119
15	Geographical Societies	137
3	Seismological reports	16
20	Meteorological reports	93
18	Botanical reports and journals	97
9	Marine Biology, Reports and papers	17
22	Zoological reports and journals	121
17	Anthropological Reports and journals	63
9	Ethnological reports and journals	63
	Useful Arts.	
18	Medical	22
2	Metrical Arts	19
15	Mining and Mineral resources	85
11	Agriculture	32
6	Forestry	6
4	Fisheries	7
14	Engineering	264
5	Military Science	9
2	Architecture	2
5	Language	24
12	Literature	90
36	Libraries, Reports, &c.,	99
8	General subjects	12
4	Philosophy	7
1	Religion	24
1	Church History	7
4	Biography	4
20	Geography	65
7	Archæology	15
21	Economics	80
12	Government	25
10	Education	33
671		7634

Government Reports of various departments are not estimated; of pamphlets, mostly German, several thousand are not sorted, and probably few are of value.

D. B. DOWLING,
Honorary Librarian.

When the Honorary Secretary had finished reading the Report, it was moved by Mr. W. D. Lighthall, seconded by Dr. A. H. MacKay, that the Report of Council be received and that the question of adoption be voted on to-morrow.—Carried.

It was moved by the Hon. Thomas Chapais, seconded by Mgr. Am.-E. Gosselin, that the election of Mr. Edouard Montpetit and the Hon. Ernest Choquette as Fellows of Section I be confirmed.—Carried.

It was moved by Hon. Mr. Justice Longley, seconded by Mr. W. D. Lighthall, that the election of Mr. James Mavor, and Dr. William Peterson, C.M.G., as Fellows of Section II, be confirmed.—Carried.

It was moved by Mr. Frank T. Shutt, seconded by Dr. R. F. Ruttan, that the election of Dr. Francis B. Allan and Dr. F. M. G. Johnson, as Fellows of Section III be confirmed.—Carried.

It was moved by Dr. A. B. Macallum, seconded by Dr. A. H. R. Buller, that the election of Dr. Thomas G. Roddick as a Fellow of Section IV be confirmed.—Carried.

Those of the new members who were present, Mr. Choquette, Mr. Montpetit, Dr. Allan and Dr. Thomas G. Roddick, were then introduced to the President, as well as Dr. A. W. H. Eaton and Mr. Hill-Tout, of Section II, who were not present when elected in 1913.

THE PRESIDENTIAL ADDRESS.

On Tuesday evening at 8.15 the Presidential Address was delivered in the Assembly Hall of the New Medical Building, McGill University. In the absence of the Vice-President the chair was occupied by Dr. LeSueur. The President's subject was "The National Domain in Canada and its proper Conservation." Instructive charts were used to illustrate the address, which is herewith printed in full as Appendix A. At the close of the lecture Mr. Vincent Meredith welcomed the Society to Montreal on behalf of the Committee of Citizens in a very cordial speech.

RECEPTION BY THE COMMITTEE OF CITIZENS OF MONTREAL.

After the close of the Presidential Address a reception was tendered the Society by a Committee of Citizens of Montreal, of which Mr. Vincent Meredith was Chairman. The halls of the New Medical Building were decorated with palms and flowers; refreshments were served and music provided. The Society and the guests, of whom several hundred were present, were received by the committee and the reception proved a most enjoyable event. During the evening there were experiments with liquid air and a very interesting exhibition of early printed books in the library and other features of interest.

SESSION II.—(Wednesday, May 27).

The President took the chair at 12 o'clock.

It was moved by Dr. Harrison, seconded by Hon. Mr. Justice Longley, that the Report of Council be adopted, with the exception

of the clause dealing with the quarterly publication of Transactions, which was left for further consideration.—Carried.

It was moved by Ven. Archdeacon Raymond, seconded by Mr. Mignault, that the following be a committee to draft a resolution expressing the Society's sorrow at the death of the founder, the Duke of Argyll, and conveying to Her Royal Highness the Duchess of Argyll deep sympathy in her bereavement:—Rev. F. G. Scott, Mr. Lambe, Dr. Plaskett, the Honorary Secretary and M. Mignault.

The Fellows of Section I announced the intention of that Section to ask the Society to elect as corresponding members the following:—

M. Henri Lorin, Professeur d'Histoire Coloniale à l'Université de Bordeaux, proposed by Dr. Ernest Myrand.

M. Etienne Lamy, de l'Académie française, proposed by Hon. Thomas Chapais.

M. Gabriel Hanotaux, de l'Académie française, proposed by Mr. Louvigny de Montigny.

The President drew attention to the invitation of the Napier Tercentenary Association to appoint a delegate to their celebration in July next and on motion of Dr. Coyne and Mr. Lighthall, Dr. J. C. McLennan was appointed to represent the Society on this occasion. Should Dr. McLennan be unable to act the matter was left in the hands of Council.

An invitation to take part in the Proceedings of the 19th Congress of Americanists in October, next, was also read and on motion of Dr. LeSueur and Dr. Raymond, Mr. Charles Hill-Tout was appointed as a representative of the Society.

Mr. Shutt read a communication from the International Association of Chemical Societies in reference to the systematisation of the bibliographical abbreviations employed in chemical memoirs, and on a motion of Mr. Shutt, seconded by Dr. Plaskett, it was decided to approve of the proposals for a uniform system whereby the confusion arising from the use of more than half a dozen abbreviations might be avoided.

Dr. Ruttan presented a question which had been discussed in the meeting of Sections III and IV, viz.—The Introduction of a Poisonous Gas, Carbon Monoxide, into Illuminating Gas. After discussion it was moved by Dr. Ruttan, seconded by Dr. J. J. MacKenzie, that a joint committee of Sections III and IV be appointed to take into consideration the best method of representing this matter to the Government.

It was moved by Mr. Lighthall and seconded by Dr. Coyne that Mr. J. Ross Robertson, who had been duly nominated, be elected a member of Section II, there being a vacancy in that Section.—Carried.

SESSION III.—(Wednesday Afternoon, May 27).

The reports of the followîng Associated Societies were read or presented:—

(1).—Royal Astronomical Society of Canada, by Dr. W. F. King, C.M.G., F.R.S.C., delegate.

(2).—Club Littéraire Canadien-Français d'Ottawa, by A. T. Genest, President and Delegate.

(3).—The Historical Landmarks Association, by G. Durnford, Honorary Treasurer, Delegate.

(4).—Women's Canadian Historical Society of Ottawa, by Mrs. J. B. Simpson, Hon. Rec. Secretary and Delegate.

(5).—The Entomological Society of Ontario, by Henry H. Lyman, F.E.S., Delegate.

(6).—The Huron Institute, by David Williams, Secretary-Treasurer.

(7).—The Women's Canadian Historical Society of Toronto, by Miss Helen Merrill, Delegate.

(8).—The United Empire Loyalists' Association of Canada, by Miss Helen Merrill, Delegate.

(9).—Canadian Forestry Association, by James Lawler, Secretary.

(10).—La Société de Géographie du Canada, by M. Eugène Rouillard, Delegate.

(11).—La Société d'Archéologie et de Numismatique de Montréal, by Victor Morin, LL.D., Delegate.

(12).—The Natural History Society of Montreal, by Rev. Robert Campbell, Delegate.

(13).—The Literary and Historical Society of Quebec, by Dr. J. M. Harper, M.A., F.E.I.S., Delegate.

(14).—The Nova Scotia Historical Society, by Hon. Justice Longley, F.R.S.C., Delegate.

(15).—The Nova Scotia Institute of Science, by Dr. A. H. MacKay, F.R.S.C., Delegate.

(16).—New Brunswick Historical Society, by Ven. Archdeacon Raymond, F.R.S.C., Delegate.

(17).—The New Brunswick Loyalists Society, by Ven. Archdeacon Raymond, F.R.S.C., Delegate.

(18).—The Natural History Society of New Brunswick, by L. W. Bailey, F.R.S.C., Delegate.

(19.)—The Elgin Historical and Scientific Institute, by Dr. J. H. Coyne, President and Delegate.

(20).—The Women's Historical Society of St. Thomas, by Margaret A. Coyne, B.A., Delegate.

(21).—The Ottawa Field Naturalists' Club, by E. D. Eddy.
(22).—The Niagara Historical Society, by Miss Janet Carnochan.

POPULAR LECTURES.

Instead of the usual popular lecture four addresses on topics of general interest were delivered by representatives of each of the four sections on Wednesday evening. This variation of the accustomed programme proved to be attractive.

The speakers and their subjects were as follows:—

Representing Section I.—P. B. Mignault, K.C., Professor of Civil Law at McGill University, on "The Royal Society and its Aims."

Representing Section II.—Adam Shortt, C.M.G., LL.D., Chairman of the Civil Service Commission of Canada, on "The Effects of Financial Reaction after a Boom."

Representing Section III.—L. A. Herdt, D.Sc., Professor of Electrical Engineering, McGill University, on "The Development of our Water Powers and their Effect on the Progress of Canada."

Representing Section IV.—C. Gordon Hewitt, D.Sc., Dominion Entomologist, on "The Destruction of Trees by Insects in Canada, and Modern Methods of Fighting Them."

Mr. Mignault's address was delivered in the French Language and Dr. Herdt and Dr. Hewitt illustrated their remarks by appropriate lantern slides.

SESSION IV.—(Thursday Afternoon, May 28).

Reports of the Sections.

SECTION I.

Procès-verbal de la séance du mardi, 26 mai, à 9.30 a.m.

Présents: M. P.-B. Mignault, président, Mgr Amédée-E. Gosselin, M. l'abbé Auguste Gosselin, MM. Benjamin Sulte, Thomas Chapais, Ernest Myrand, P.-G. Roy, Adjutor Rivard, Léon Gérin, Ernest Choquette, Edouard Montpetit et Louvigny de Montigny.

Mgr Louis-Ad. Paquet s'est excusé, pour cause de maladie.

Délégués: M. le notaire Victor Morin, M. Pemberton Smith et M. E.-Z. Massicotte, représentant la Société de Numismatique et d'Archéologie de Montréal; M. Arthur-T. Genest, représentant le Club Littéraire Canadien-français d'Ottawa.

Le secrétaire rapporte le cas de MM. Hector Garneau et Eugène Rouillard qui, aux dernières élections de la Société Royale, ont obtenu chacun un nombre de voix égal, et suffisant aux termes des règlements, mais qui n'ont pas été déclarés élus, une seule vacance restant à remplir.

M. Gérin, appuyé par M. de Montigny.

Propose: Que la Section I présente un rapport à l'assemblée générale pour la prier de suspendre le règlement relatif aux dernières élections de la Société Royale et de déclarer élus MM. Garneau et Rouillard.

M. Chapais, appuyé par M. Rivard, propose en

Amendement: Que la Section I ne voit pas l'urgence qui justifierait une demande de suspension des règlements, MM. Garneau et Rouillard pouvant être présentés aux prochaines élections en vertu du paragraphe 4 de l'article 6 des règlements; que, conséquemment, la Section I recommande que soit annulée l'élection à la troisième vacance que la Section I avait à remplir au cours du dernier exercice, et que, en vertu de l'article 8 des règlements, la Section I réclame le droit d'élire trois nouveaux membres aux prochaines élections.

Mgr A.-E. Gosselin, l'abbé Auguste Gosselin, MM. Chapais, Rivard, Myrand et Roy votent en faveur de l'amendement qui est ainsi affirmativé, les autres membres étant absents ou s'abstenant.

Le secrétaire soumet une lettre du secrétaire général, en date du 21 avril dernier, informant la Section I que Mgr Bégin, Mgr Bruchési, sir François Langelier et M. Ernest Gagnon, par l'effet de l'article 8 des règlements, doivent être considérés comme démissionnaires, et qu'une résolution doit être adoptée pour couvrir le cas particulier de M. l'abbé Camille Roy.

Sur proposition de M. Chapais, appuyé par M. Rivard, il est

Résolu: Vu l'urgence, de recommander à l'assemblée générale de suspendre l'effet des règlements dans le cas de Mgr Bégin, Mgr Bruchési, sir François Langelier et M. Ernest Gagnon qui, à cause des éminents services par eux rendus aux lettres canadiennes, sont dignes de rester membres de la Société Royale, malgré l'empêchement dans lequel ils se trouvent de prendre part à ses travaux; et qu'ils soient maintenus dans les cadres de la Section I durant une année.

Il est aussi

Résolu: En vertu de l'article 8 des règlements, de maintenir M.l'abbé Camille Roy dans les cadres de la Section I durant une année.

Sur proposition de M. l'abbé Auguste Gosselin, appuyé par M. Myrand, il est

Résolu: Que M. P.-B. Mignault soit nommé membre du comité de mise en nomination des dignitaires généraux de la Société Royale, avec M. Benjamin Sulte qui a été choisi, l'an dernier, pour faire partie de ce comité.

Sur proposition de MM. Chapais, Myrand et de Montigny, il est

Résolu: De donner avis à l'assemblée générale que la Section I, conformément à l'article 7 des règlements, proposera à ses suffrages, comme membres correspondants de la Société Royale du Canada, M. Etienne Lamy, secrétaire perpétuel de l'Académie française, M. Gabriel Hanotaux, de l'Académie française, et M. Henri Lorin, professeur d'histoire coloniale à l'Université de Bordeaux, qui ont tous trois témoigné aux lettres et à l'histoire du Canada un dévouement et des sympathies qui doivent être reconnus.

Sur proposition de Mgr. A.-E. Gosselin, appuyé par M. Choquette, il est

Résolu: Qu'un très grand nombre des membres de la Société Royale appartenant au Parlement, aux Universités et au Service Civil, et le mois de mai leur ménageant ordinairement un surcroît de besogne qui leur rend difficile et parfois impossible d'assister à l'assemblée annuelle de la Société Royale, le Conseil soit prié de fixer au mois d'octobre la date des prochaines assemblées annuelles.

Sur proposition de M. de Montigny, appuyé par M. Choquette, la Section I émet le vœu suivant:

Considérant qu'il est de toute nécessité de procurer de l'encouragement aux études et aux travaux littéraires et scientifiques, et que cet encouragement doit d'abord venir de l'Etat;

Qu'une délégation de la Société Royale se présente auprès du gouvernement pour le prier d'affecter annuellement un crédit spécial dont le quart sera attribué à chacune des quatre Sections de la Société Royale pour couronner et récompenser (aux conditions que le gouvernement pourra déterminer) un essai littéraire ou scientifique, selon le cas, relevant de chaque Section, et dont l'auteur sera par elle jugé digne d'encouragement;

Et que, le gouvernement ayant donné l'exemple, les Législatures provinciales, les corps publics et les particuliers soient invités à créer des prix littéraires ou scientifiques qui porteront leurs noms, et que les diverses Sections de la Société Royale se chargeront volontiers de décerner, aux conditions imposées par les fondateurs de ces prix.

Les manuscrits suivants sont soumis:

1°—*Premières concessions de terrain à Montréal, 1648-1665.* E.-Z. Massicotte, présenté par M. Sulte;

2°—*La Noblesse au Canada durant le XVIIe siècle.* M. Benjamin Sulte;

3°—*Les Indiens du Canada, depuis la découverte,* C.-M. Barbeau, présenté par M. L. de Montigny;

4°—*France et Canada: Dieppe-Québec (1639); Québec-Dieppe (1912.)* M. l'abbé Auguste Gosselin;

5°—*L'Intérêt sociologique de l'Œuvre de Garneau.* M. Léon Gérin;

6°—*La question de la Réforme orthographique.* M. Adjutor Rivard;

7°—*Le Rituel du Diocèse de Québec par Monseigneur de Saint-Vallier, second évêque de Québec.* Mgr. A.-E. Gosselin;

8°—*Deux oubliés de l'Histoire: Jean-Baptiste Bruce et Jean-Louis Légaré.* M. le juge L.-A. Prud'homme.

9°—*Durham-Dufferin-Elgin.* M. le sénateur L.-O. David.

10°—*La langue française en Angleterre.* M. A.-D. DeCelles.

Procès-verbal de la séance du mardi 26 mai, à 3 heures p.m.

Présents: les mêmes et M. A.-D. DeCelles.

M. DeCelles rapporte le cas du R. P. Paul-V. Charland qui, ayant été envoyé en mission aux Etats-Unis par ses supérieurs ecclésiastiques, est démissionnaire aux termes du paragraphe 3 de l'article 8 des règlements; et il demande que le R. P. Charland soit réinstallé.

Après étude des règlements, il est

Résolu: Que le R. P. Charland, ayant cessé d'appartenir à la Société Royale, devra se présenter de nouveau à l'élection.

Sur proposition de M. Mignault, appuyé par M. Montpetit, il est

Résolu: Que MM. Léon Gérin et Adjutor Rivard soient priés de se charger de la traduction française des règlements de la Société Royale.

Les manuscrits de MM. E.-Z. Massicotte et Benjamin Sulte et de Mgr A.-E. Gosselin sont étudiés et renvoyés au comité de lecture.

Procès-verbal de la séance du mercredi, 27 mai, 9.30 a.m.

Présents: les mêmes.

Le président informe la Section que M. Ernest Myrand a déposé à la Section la troisième édition de son ouvrage "*Noëls anciens de la Nouvelle-France.*"

Sur proposition de M. Rivard, appuyé par M. Chapais, il est

Résolu: Que la Section I choisit M. de Montigny, secrétaire, pour la représenter dans le bureau de publication.

Sur proposition de M. Rivard, appuyé par Mgr A.-E. Gosselin, il est

Résolu : Que la Section I déclare être favorable à la publication des mémoires de la Société Royale par fascicules trimestriels, les travaux des deux Sections I et II devant être réunis en un seul fascicule.

Sont étudiés les manuscrits de MM. L.-A. Prud'homme, l'abbé Auguste Gosselin, C.-M. Barbeau, Léon Gérin, et renvoyés au comité de lecture.

Procès-verbal de la séance du jeudi, 28 mai, à 10 heures a.m.

Présents: les mêmes et M. le sénateur Pascal Poirier.

Sur proposition de M. Sulte, appuyé par M. Chapais, il est

Résolu: Que le bureau de la Section I soit constitué comme suit pour le prochain exercice: Président, M. Rodolphe Lemieux; vice-président, Mgr. A.-E. Gosselin; secrétaire, M. Louvigny de Montigny.

Sur proposition de M. Sulte, appuyé par M. Gérin, il est

Résolu: Que le comité de lecture de la Section I soit constitué comme suit pour le prochain exercice: MM. De Celles, Rivard et Montpetit.

Sur proposition de M. de Montigny, appuyé par M. Choquette, il est

Résolu : De réaffirmer les vœux émis l'an dernier par la Section I, relativement à la protection des droits d'auteur et à l'établisements d'un hôtel particulier de la Société Royale à Ottawa; et de prier le Conseil de continuer ses démarches auprès du gouvernement pour la réalisation de ces vœux.

Est étudié le manuscrit de M. Adjutor Rivard, et renvoyé au comité de lecture.

Les manuscrits de MM. A.-D. De Celles et le sénateur David n'ayant pu être étudiés par la Section, faute de temps, sont renvoyés au comité de lecture.

Le tout humblement soumis.

L. DE MONTIGNY,
Secrétaire
Section I.

On the motion of Dr. Mignault, seconded by Mr. de Montigny, the report of Section I was adopted.

It was moved by Dr. Mignault, seconded by Mr. de Montigny, that the Honorary Secretary cast a ballot for the election as corresponding members, of Mr. Hanotaux, Gabriel, de l'Académie française, 21 rue Cassette, Paris; Mr. Lamy, Etienne, secrétaire perpétuel de l'Académie française, 3, place d'Iéna, Paris, and Mr. Lorin Henri, professeur d'histoire coloniale à l'Université de Bordeaux, 23, quai des Chartrons, Bordeaux. The ballot having been cast, the election was confirmed.

REPORT OF SECTION II.

Section II met at the New Medical Building of McGill University at 11 a.m.

Present: —Hon. Mr. Justice Longley, President, in the chair,—Fellows: D. C. Scott, Hill-Tout, Jones, Coyne, McLachlan, LeSueur, Lighthall, F. G. Scott, Eaton, Raymond, Shortt.

Professor Pelham Edgar's paper on "Matthew Arnold as a Poet," was read and discussed.

Dr. Eaton gave the outlines of his paper on "The Peopling of Hants County, Nova Scotia, from Rhode Island in 1760." The paper was followed by considerable discussion.

Rev. F. G. Scott read, "A group of Poems: Songs of the Islands of the Gulf of Georgia," by Clive Phillips-Woolley.

Venerable Archdeacon Raymond read his paper on "The First Governor of New Brunswick and the Acadians of the River St. John."

The meeting adjourned at 12.45.

The Section reassembled at 2.45.

Mr. R. W. McLachlan gave an account of the paper by Miss Charlton, entitled, "Some unpublished letters and part of a dairy of Joseph Frobisher and James McGill."

Mr. W. A. Munn's paper on "Wineland the Good" was read. He holds that Vinland is the extreme north of Newfoundland.

Concerning the form of the publication of the proceedings—annual or quarterly—discussion was adjourned.

On Wednesday, May 27th, the section reassembled at Laval University.

It was resolved that Mr. John Ross Robertson be elected to the Section, and a ballot was consequently cast in his favour. This election was ratified by the Society the same morning.

It was resolved that the Society be asked for the privilege of electing two additional members during the coming year

Rev Father Jones read his paper on "Palæological and Archæological Frauds," taken with the discussion led by W. D. Lighthall, on "Spurious Portraits of Canadian Historical Characters."

As to publication of transactions it was resolved that Section II join with Section I in publishing their papers in the form of a quarterly, it being understood that no papers be published by this Section which have not been read or approved by the Section. It was further resolved to ask that at the end of the year the quarterly sections be bound together and so issued to the members.

A printing Committee was appointed consisting of Drs. LeSueur and Coyne and Mr. Burpee.

Dr. LeSueur presented the two papers of Dr. Siebert on the Loyalists of Machiche, P.Q., and of Gaspé.

Mr. D. C. Scott called attention to Professor Wrong's paper on "Bourlamaque."

The papers on "Highways of the Fur Trade," by Mr. Burpee, and "The Capture of Oswego," by Dr. Grant, were read.

The elections of the Section were as follows:

President: R. W. McLachlan.

Vice-President: Dr. Shortt.

Secretary: W. D. Lighthall, K.C.

The meeting then adjourned.

On the motion of Dr. Coyne, seconded by Dr. LeSueur, the report of Section II was adopted.

REPORT OF SECTION III.

Five Sessions of the Section were held, all being well attended by Fellows and others, two each on May 26 and 27, and one on the 28th. There were 15 members present at these Sessions, namely Messrs. Allan, Baker, Barnes, Burton, Dawson, Eve, Harkness, King, McIntosh, McLennan, McLeod, Plaskett, Ruttan, Shutt, Stupart.

Twenty-eight papers, many of them of great value and interest, including the Presidential Address on The Science of Meteorology and an interesting Symposium on theStructure of the Atom were presented to the Section, most of which were interestingly discussed.

The election of officers of the Section for the ensuing year resulted as follows:—

President—E. Deville, LL.D., F.R.S.C.

Vice-President—F. T. Shutt, M.A., F.R.S.C.

Secretary—J. S. Plaskett, D.Sc., F.R.S.C.

It was decided that any vacancies in the Section be filled and two new members be elected next year.

It was also decided that action under Clause 8 of the By-Laws be suspended for another year in the case of the member who had not complied with the regulations regarding attendance or presentation of papers.

The officers of the Section were appointed as the Sectional Printing Committee.

The Section recommended to the Society the appointment of a Committee to obtain full information as to the dangers to life arising from the presence of carbon monoxide gas in ordinary illuminating gas with a view of directing the attention of the Government to this matter and in the hope of limiting the use of this dangerous mixture.

The Section further recommended that the Society adopt the proposal of the International Chemical Association to systematize the abbreviations of periodicals referred to in chemical memoirs.

The question of the change in the method of publication proposed in Section VIII of the Report of Council was very fully discussed and carefully considered by the Section. The members were unanimously in favour of the proposed change and recommended that a strong committee be appointed to arrange all details.

List of Papers Presented in Section III.

1.—Presidential Address—Science of Meteorology, R. F. Stupart, F.R.S.C.

2.—The Vapour Pressures of the Hologen Hydrides and of Hydrogen Sulphide, O. Maas and D. McIntosh, F.R.S.C.

3.—On the Structure of the Atom, Prof. A. S. Eve, F.R.S.C., and Prof. J. C. McLennan, F.R.S.C.

4.—The Absorption of the X-Rays by the Rare Earths, Dr. J. A. Gray, Presented by Prof. A. S. Eve, F.R.S.C.

5.—The Penetrating Power of B-Rays excited by X-Rays, by Dr. J. A. Gray, presented by Prof. A. S. Eve, F.R.S.C.

6.—Some experiments in connection with the Theory of Probability, by Prof. Alfred Baker, F.R.S.C.

7.—An Osmosis in Soils, by C. J. Lynde and J. V. Dupre, presented by Prof. H. T. Barnes, F.R.S.C.

8.—The Nitrogen Compounds in Rain and Snow, Prof. Frank T. Shutt, F.R.S.C.

9.—The Dawson Isothermal Stratum of Low Temperatures in the Gulf of St. Lawrence, by Prof. H. T. Barnes, F.R.S.C.

10.—Records of the Difference in Temperature between Mount Royal and McGill College Grounds, Prof. C. H. McLeod, F.R.S.C., and Prof. H. T. Barnes, F. R.S.C.

11.—The Crushing Strength of Ice, Prof. H. T. Barnes, F.R.S.C.

12.—The Expansive Force of Ice, Prof. H. T. Barnes, F.R.S.C. J. W. Haymard and Norman McLeod.

13.—The Cubical Expansion of Quartz, N. E. Wheeler, presented by Prof. H. T. Barnes, F.R.S.C.

14.—The Coefficient of Expansion of Mercury at Low Temperatures, C. B. James, presented by Prof. H. T. Barnes, F.R.S.C.

15.—The Contact Resistance of Metals and Alloys, H. E. Reills, presented by Prof. H. T. Barnes, F.R.S.C.

16.—On Prism Material for Stellar Spectrographs, Dr. J. S. Plaskett, F.R.S.C.

17.—The New 72 Inch Reflecting Telescope for Canada, Dr. J. S. Plaskett, F.R.S.C.

18.—On the Fluorescence of Iodine Vapour Excited by Ultra-Violet Light, Prof. J. C. McLennan, F.R.S.C.

19.—On the Mobilities of Ions in Gases at High Pressures, Prof. J. C. McLennan, F.R.S.C.

20.—To Determine by Rational Operations whether an Algebraic Curve is or is not Reducible, Prof. J. C. Fields, F.R.S.C.

21.—Hydro Electric Developments, Dr. L. A. Herdt, F.R.S.C.

22.—On the use of the Kelvin-Varley Slide Potentiometer, A. Norman Shaw, M.Sc., presented by Prof. H. T. Barnes, F.R.S.C.

23.—On the Sound Efficiency of Fog-Signal Machines. An account of Experiments carried out at Father Point, September, 1913, Louis V. King, B.A., presented by Prof. H. T. Barnes, F.R.S.C.

24.—The Behaviour of Carbon Filament Lamps under Electric Force, Prof. A. S. Eve, F. R.S.C.

25.—On the connection between two Expansions in Bessel's Series, J. Harkness, F.R.S.C.

26.—Measurements on the amount of Chlorides in the Atmosphere under Varying Conditions, Francis J. Lewis, D.Sc., presented by Dr. H. M. Tory, F.R.S.C.

27.—On a Determination of Avogadro's Number by the Application of Rayleigh's Law to the Smithsonian Observations of the Absorption of Solar Radiation by the Earth's Atmosphere, Louis V. King, B.A., presented by Prof. H. T. Barnes, F.R.S.C.

28.—On the Diurnal Changes in Magnetic Declination at Agincourt, 1902-12, W. E. W. Jackson, M.A., presented by R. F. Stupart, F.R.S.C.

On motion of Mr. Stupart, seconded by Professor McLeod, the report of Section III was adopted.

REPORT OF SECTION IV.

Section IV held four sessions which were attended by sixteen Fellows and a number of visitors. Twenty-five papers were read, either in full or by title; a list of these is appended. These papers provoked a lively discussion and were listened to with great interest by the members of the Section.

The following members were nominated for the Sectional Printing Committee:—

Mr. Dowling, Dr. Hewitt and Dr. Harrison. Mr. Dowling was nominated to act upon the General Printing Committee of the Society.

The Sectional Officers for the ensuing year were elected as follows:

President............. Professor A. H. R. Buller.
Vice-President......... Mr. J. B. Tyrrell.
Secretary............. Professor J. J. Mackenzie.

A letter from Mr. A. McDonald upon the establishment of laboratories for the study of criminals and defectives transmitted to the Section by the General Secretary, was fully discussed. Upon motion the Section decided to refer the whole matter to a Committee as follows:—

Dr. MacKay, Dr. Knight, Dr. Burgess, Dr. Nicholls and Dr. Mackenzie to report at the next meeting of the Society.

A motion was unanimously passed by Section IV that in 1915 the maximum number of Fellows elected to the Section should be four.

Dr. B. A. Bensley, having been unable to attend the Society for three years, a resolution was passed extending, under By-Law 8, his Fellowship for one year.

The Section considered carefully the resolution transmitted to it from Section III in regard to the dangers of poisoning from Carbon Monoxide Gas. The Section desires to support the resolution and has nominated Dr. T. G. Roddick and Professor Mackenzie to act with the Committee of Section III to draw up a report upon the matter.

The report of the Council in regard to change in publication was considered and the Section desires to report that it supports Council's recommendation in all details.

List of Papers presented in Section IV.

1.—Bibliography of Canadian Botany for the year 1913, by A. H. MacKay, F.R.S.C.

2.—Bibliography of Canadian Entomology for the year 1913, by C. J. S. Bethune, F.R.S.C.

3.—Bibliography of Canadian Zoology for the year 1913, (Exclusive of Entomology). by E. M. Walker.

4.—Bibliographies of Canadian Geology for the year 1912 and 1913, by Wyatt Malcolm, presented by R. W. Brock, F.R.S.C.

5.—On the Systematic Position of Haplobothrium Globuliforme, by A. R. Cooper, M.A., Biological Dep't. Univ. of Toronto.

6.—On the Heat Resistance of Bacteriological Endospores, with a Consideration of the Properties and Nature of the Spore-like Bodies seen in Tubercle and Allied Bacilli, by Eleanor Shanley.

7.—Note on the Structure of Haemal and Lymphatic Glands, by Swale Vincent, F.R.S.C., and K. J. Austmann..

8.—Some Observations upon the Vasor-motor Reflexes, by Swale Vincent, F.R.S.C., and A. T. Cameron.

9.—The Distribution of Iodine in Plant and Animal Tissues, by A. T. Cameron.

10.—The Effect of Thyroid Feeding upon the Growth of Young. Rats, by A. T. Cameron.

11.—The Effects of Music upon the Blood-Pressure, by Swale Vincent, F.R.S.C., A. T. Cameron, and H. P. Armes.

12.—Further Experiments on the Effect of Low Temperatures on the Frog, By A. T. Cameron.

13.—Amphistomum Subtriquetrum Rudolphi, with Notes on Sphyranura Osleri Wright and Macallum, by Dorothy Duff, B.A.

14.—The Physics of the Cambrian Formation in Eastern Canada, and the Peculiarities of its Faunas, by G. F. Matthew, F.R.S.C.

15.—(1) A New Species of Aspideretes from the Belly River Formation of Alberta, with further information Regarding the Structure of the Carapace of Boremys Pulchra. (Illustrated.)

(2) Description of a New Species of Platysomus from the Neighbourhood of Banff, Alberta, (Illustrated.) by Lawrence M. Lambe, F.R.S.C.

16.—On the Nervous System of the Larva of Sphida Obliqua Walker, by E. Melville DePorte, presented by F. C. Harrison, F.R.S.C.

17.—Remarks on the Plankton and other Diatoms of the East Coast of Vancouver Island, B.C., by L. W. Bailey, F.R.S.C.

18.—Correlation of the Pre-Cambrian Rocks of Ontario, Western Quebec and Southeastern Manitoba, by Willet G. Miller, F.R.S.C. and Cyril W. Knight.

19.—On the Feeding Habits of the Stable Fly, *Stomoxys calcitrans*, by C. Gordon Hewitt, F.R.S.C.

20.—On the Destruction of Trees by Insects in Canada, by C. Gordon Hewitt, F.R.S.C.

21.—Upon the Subterranean Parts of the Fruit-bodies of Certain Hymenomycetes, by Professor A. H. Reginald Buller, F.R.S.C.

22.—On Circulating Excitations in Heart Muscle and Their Possible Relation to Tachycardia and Fibrillation. by Dr. George Ralph Mines.

23.—On The Secretion of Hydrochloric Acid in the Peptic Glands, by J. B. Collip, M.A., presented by Dr. A. B. Macallum, F.R.S.C.

24.—Microchemical Studies on the Intestinal Epithelial Cells, by J. H. Howell, M.A., presented by Dr. A. B. Macallum, F.R.S.C.

25.—Notes on some Tick Bites in Canada, by John Todd, M.D., presented by Dr. Frank D. Adams, F.R.S.C.

On motion of Dr. J. J. MacKenzie, seconded by Dr. Macallum, the Report of Section IV was adopted.

The report of the Nominating Committee was then presented by Dr. Sulte.

The following nominations were made:—

For President—Sir Adolphe Routhier.
For Vice-President—Professor Alfred Baker.
For Honorary Secretary—Duncan C. Scott.
For Honorary Treasurer—Dr. C. Gordon Hewitt.
For Honorary Librarian—D. B. Dowling.

It was moved by Dr. Macallum, seconded by Dr. Coyne, that Sir Adolphe Routhier be president for the ensuing year.—Carried.

It was moved by Dr. MacKay, seconded by Mgr. A. Gosselin, that Professor Alfred Baker be Vice-President for the ensuing year.—Carried.

It was moved by Mr. McInnes, seconded by Dr. King that Mr. Duncan C. Scott be Hon. Secretary for the ensuing year.—Carried.

It was moved by Dr. Buller, seconded by Dr. Macallum, that Mr. D. B. Dowling be Hon. Librarian for the ensuing year.—Carried.

It was moved by Dr. LeSueur, seconded by Dr. Adams, that the Society place on record its sense of the value of the past services of Dr. S. E. Dawson and its regret that he was unable to be present on the occasion of this meeting.—Carried.

It was moved by Dr. Sulte, seconded by Dr. Matthew, that the Royal Society of Canada, at its thirty-third annual meeting held in the City of Montreal, desires to place on record the deep sense of the loss which it has sustained in the death of its founder, His Grace the Duke of Argyll.

Himself a man of letters and wide culture, he early saw the importance during his residence in Canada, of uniting and federating

into one organization the various literary and scientific forces in our national life. The result was the formation of the Royal Society of Canada, a Society which will, we trust, more and more play a most important part in securing and guiding the intellectual and moral developments of the Dominion.

With gratitude then, the Society desires to pay this tribute of respect to his memory, and at the same time to express the profound sympathy of its members with Her Royal Highness the Duchess of Argyll in her bereavement.—Carried.

Moved by Dr. Buller, seconded by Dr. Mignault, that the hearty thanks of the Society be tendered to the Board of Governors of McGill University and the Administrators and Governors of Laval University for inviting the Society to meet in Montreal and for placing at its disposal their commodious and beautiful buildings.

Moved by Dr. Harrison, seconded by Senator Poirier, that the cordial thanks of the Society be tendered to Vincent Meredith, Esq., and the Montreal Citizens' Committee for the reception accorded the Society.—Carried.

Moved by Dr. LeSueur, seconded by Dr. Coyne, that the thanks of the Society be tendered to the Antiquarian and Numismatic Society for the courtesy extended to the members and delegates in entertaining them at the Chateau de Ramezay.—Carried.

Moved by Mr. D. B. Dowling, seconded by Dr. A. H. MacKay, that the thanks of the Society be tendered to the Montreal Tramways Company for their kindness in placing a car at the disposal of the Society to visit the Chateau de Ramezay.—Carried.

Moved by Mr. R. F. Stupart, seconded by Dr. McLennan that the thanks of the Society be tendered to the Montreal Harbour Commissioners for their kindness in placing at the disposal of the Society a steamer for an excursion on the harbour.—Carried.

Moved by Dr. McLennan, seconded by Dr. Coyne, that a cordial vote of thanks be presented to the President and other officers of the Society for their services during the past year.—Carried.

The meeting was then declared adjourned by the Vice-president.

APPENDIX A

PRESIDENTIAL ADDRESS

THE NATIONAL DOMAIN IN CANADA AND ITS PROPER CONSERVATION

BY

FRANK D. ADAMS, Ph.D., D.Sc., F.R.S., F.G.S

THE NATIONAL DOMAIN IN CANADA AND ITS PROPER CONSERVATION

It is in many ways an exhilarating experience, that of living in a new country, and in a time of rapid development. We, the Canadian people, have entered into a great heritage—half a continent—standing midway between two of the most densely populated areas of the earth, Europe and Eastern Asia, and having to the south one of the most progressive nations of the world. We are blest with a most liberal form of government and have ample room for expansion, and are thus free from the many limitations which beset the densely crowded peoples of other countries; we are also free from the ever-present danger of war and invasion which, like the sword of Damocles, hangs over the head of every nation of the older world. This gives a sense of security which is never felt in the countries across the seas. We have, moreover, the advantage of the protection of a great Empire while bearing less than our proper share of its burdens.

The population which is rapidly flowing into the Dominion is furthermore of a relatively high quality. Of the 384,867 immigrants who came to Canada in the year 1913, 65 per cent were from Great Britain and Ireland or from the United States and consequently spoke the English language as their native tongue, while of the immigrants entering the United States a relatively much larger percentage come from southern Europe. Even our somewhat bracing climate is not without its advocates. I remember having heard Dr. Parkin remark one bright winter's day, when the thermometer stood at $-20°$ F., that our cold winter was one of Canada's best assets, seeing that it keeps away negroes and all those other undesirable elements of permanent population classed by the unlearned under the comprehensive title of "dagos." We have, in fact, been told on high authority that the twentieth century belongs to Canada and any one who travels in western Canada and talks with our people there will certainly be led to believe that this is their understanding of the case.

Canada is often referred to as being in her constructive period. The United States is somewhat more advanced in its material development, having now nearly completed its constructive period. Its chief lines of railway were built some years ago; its free lands are taken up and the country is settled. The crops once largely exported are now for the most part required to feed its own people. Canada may read its own immediate future by studying the present situation in the United States—a generation ago her west was as ours is now.

We find, however, that in the great republic to the south a very strong note of warning is already being sounded in respect to its future. This took form in an address delivered by President Roosevelt to the Society of American Foresters in 1903. In September, 1906, Mr. James J. Hill delivered an address which presented for the first time in popular form, under the title of "The Future of the United States," a remarkable collection of economic facts. Let me give a brief summary of its contents:

The supply of coal and iron, a prime factor in the nation's industry and commerce, was being exhausted at a rate which made it certain that before the end of the century the most important manufactures would be handicapped by a higher cost of production. The supply of merchantable timber was disappearing at a much more rapid rate. But far more serious than all other forms of wastage was the reckless destruction of the natural fertility of the soil. Within a period for which the present generation was bound to provide, the United States would be pressed hard to feed its own people. Mr. Hill told his hearers that the danger which threatened the future food supply of the nation could be averted only by the intelligence and industry of those who cultivated the farm lands, and that they had it in their power to provide a perfectly practicable and adequate remedy by applying the discoveries of physical science to the business of farming.

Many other men of leading in the United States, among whom Mr. Gifford Pinchot must be especially mentioned, became impressed with the importance of these great questions, and in May, 1908, President Roosevelt called at the White House in Washington, a conference of the governors of all the states in the union, members of the Cabinet, justices of the Supreme Court, together with the heads of the great scientific bureaus of Washington and other leading citizens, to consider the question of "the conservation of our natural resources," stating that in his opinion this was "the weightiest problem now before the nation." The importance which was attached to this conference was marked by the fact that, for the first time in the history of the nation, the Governors of all the states were assembled to consider a great national question. This led to the appointment of a National Commission of Conservation.

Following this, the Governments of Canada, Newfoundland and Mexico were invited to join with the Government of the United States in appointing representatives to a North American conference to meet in Washington in February, 1909. Upon the receipt of the report of the Canadian representative at this great conference, our Government decided to appoint a permanent Commission of Conser-

vation in Canada, which Commission has been actively at work since that time under the able chairmanship of Mr. Clifford Sifton.

If the conservation of their natural resources is a question of such pressing importance in the United States, it is of equal, if not of greater, importance here in the Dominion of Canada; it is of the greatest moment for the future of Canada that the leaders of our national thought and through them all the citizens of our Dominion should be seized with the importance of the principles underlying this great movement. I therefore desire this evening to bring to your attention certain salient facts concerning our national resources, their proper development and their conservation.

It is a common idea that the conservation of our natural resources means hoarding them for the use of future generations. This is an entire misconception. Most of our natural resources are best conserved by working and developing them. Our forests, our lands and our fisheries will, if properly worked, not only yield this generation a larger profit, but they will be handed on to our successors in a more highly productive condition than that in which we received them. We are prosperous now, but we must not forget that it is just as important that our descendants should be prosperous in their turn. Each generation is entitled to the interest on the natural capital, but the principal should be handed on unimpaired.

The subordination of the consideration of the welfare of the nation to the pursuit of personal wealth, which is so widespread in the Dominion at the present time, is, it is to be hoped, merely a product of our present phase of development, but it is destructive to all true national life and to the development of a strong and happy people; it is as true now as in past ages that "where there is no vision, the people perish." Over the whole principle of conservation a great moral issue reigns supreme. Its acceptance is a test of national efficiency.

General Statement Concerning the Physical Features and the Natural Resources of Canada.

The area of the Dominion of Canada is about 3,730,000 square miles, which is somewhat greater than that of the United States including Alaska, and rather less than that of Europe.

In Canada, as in every other country of the world, the physical features have played, are playing and will continue to play a most important part in the development of the history of the country and the character of its people.

Looking back into the abyss of past time, we find that that part of North America which we now call Canada originally consisted of three widely separated land areas rising from the waters of the primeval ocean. These areas are sometimes termed the protaxes or primitive axes of North America. I refer to them at the present time because, while the eastern and western protaxes, marking the lines along which our mountain ranges were subsequently developed, became more or less buried beneath the blanket of sediments which filled in this early outline of the continent; the great northern protaxis, composed of the hard granite and crystalline schists of that ancient time, has remained exposed to the present day. Its enormous expanse of 2,000,000 square miles represents more than half of the whole area of the Dominion of Canada. Driven down like a wedge into southern Canada, it separates the older settlements of eastern Canada from the new provinces of our west. Owing to its peculiar and more or less barren character it has in this way exerted a most potent and in some respects sinister influence in the development of our Dominion. It will be noted that this northern protaxis or "Canadian shield," as it has been called by the great Austrian geologist Suess, barely passes south of the Canadian boundary line. The problems which it presents in Canada, are, therefore, non-existent in the United States.

Canada falls naturally into the following physiographic divisions:

The Canadian Shield—to which reference has just been made. This is a great plateau with an average elevation of about 1,500 feet above sea level. A somewhat undulating, rocky country, in the south well wooded but containing little farming land.

The Appalachian Mountain System—represented in Canada by the Notre Dame and Shickshock Mountains—which crosses the boundary line from New Hampshire and runs in a curving north-easterly course through the province of Quebec to the extremity of the Gaspé peninsula.

The Area of the Maritime Provinces—This lies to the east of the Appalachian Mountain System—a diversified tract of country containing considerable areas of good farming land and with important coal deposits.

The Great Plain of Central Canada—This lies along the southern margin of the Canadian Shield and stretches from the Appalachian Mountains on the east to the Rocky Mountains on the west. Its eastern portion lies in the provinces of Quebec and Ontario, its western and larger portion separated, however from the eastern portion by the northern protaxis in the lake Superior region, forms the greater part of Manitoba, Saskatchewan and eastern Alberta. It contains most of the farming land in the Dominion.

MAP SHOWING GENERAL PHYSIOGRAPHIC DIVISIONS OF THE DOMINION OF CANADA

The Cordilleran Mountain System—of which the Rocky Mountains are the eastern range. This system of mountain ranges with its intervening valleys and plateau lands bounds Canada on the west and embraces British Columbia and western Alberta. It has the finest surviving forests of the Dominion and is rich in minerals. It contains, however, only a relatively small amount of farming land which can be cultivated without irrigation.

The natural resources of the Dominion on which the population of Canada must depend for their support are six in number:

(1) Agriculture and the cattle trade.
(2) Forest products, timber, pulp-wood, etc.
(3) Water powers.
(4) Mines.
(5) Fisheries.
(6) Fur trade.

Speaking generally, our manufactures and transportation systems are dependent upon these and, therefore, stand or fall with them.

The relative importance of these several sources of national wealth, as expressed in the monetary value of their respective products, is shown in the accompanying table. The figures are obtained from the Government returns for the year 1913.

In the table there is also given, for purposes of comparison, the value of the exports of each of these national products.

These figures, are set forth in graphic form in the accompanying diagram.

	Output in dollars.	*Export in dollars.*
Agriculture (including dairy products and cattle).	673,771,500*	194,930,254
Forests (1912)	182,300,000	43,255,060
Mines	144,031,047	57,442,546
Fisheries	33,389,461	16,336,721
Furs	——	5,415,118

Let us look briefly at the extent and the present status of the development of each of these great sources of national wealth in the Dominion.

*This does not include cattle, no return for these being made to the Government, except in exports.

Agriculture.

Agriculture is and must always remain the chief industry of the people of Canada. The population which the Dominion can support in the future will depend chiefly upon the area of land suitable for farming which exists in Canada and the manner in which this is cultivated.

The fact that Canada occupies more than half of the continent of North America and has an area almost identical with that of Europe is sometimes mentioned as carrying with it the implication that it would afford support to an almost unlimited population.

It is impossible at the present time to arrive at an accurate estimate of the actual area of arable land in the Dominion, but there are certain salient facts which, while not generally recognized, have a very important bearing on this question.

The first of these is that there is practically no land which can be properly cultivated in that portion of Canada which lies north of the area indicated on the accompanying map as being covered by a forest growth.

Secondly, with the possible exception of the clay belt in northern Ontario, there is no part of the Canadian Shield which can support more than a very sparse farming population or in which farming can be made a really profitable industry. The recent report of the Commission of Conservation on the condition of the farming community on the southern margin of the shield on the watershed on the Trent Valley Canal in southern Ontario, shows a state of affairs long recognized by those familiar with the Laurentian country.

Thirdly, the area of arable land in British Columbia, as compared with the size of the province, is quite small.

There are only two great areas of land capable of continuous cultivation throughout their entire extent and of thus supporting a large agricultural population. The first of these is the plain lying between the southern margin of the Canadian Shield and the boundary line of the United States in Quebec and Ontario, extending from the hilly or mountainous district of the Appalachian folding in eastern Quebec to the Great Lakes. The second is the southern portion of the plains in the provinces of Manitoba, Saskatchewan and eastern Alberta. These, in referring to the physiographic divisions of Canada, were classed together as the Great Plain of Central Canada.

Many of the estimates which have been made of the amount of land which is suitable for farming in the Dominion are undoubtedly too high. A recent writer has stated that "a conservative and easily grasped statement is that the farm lands of Canada would fill a strip

VALUE OF OUTPUT AND EXPORTS OF CANADIAN INDUSTRIES IN THE YEAR 1913

of country the width of France and 3,000 miles long." Canada is 3,000 miles across from ocean to ocean and France 400 miles wide. This would give to the farming land of the Dominion an area of 1,200,000 square miles. If anyone who is well acquainted with Canada will draw a line parallel to the southern boundary of Canada but 400 miles distant from it, he will find that there is not very much farming land to the north of this line, while there are vast tracts of country on which he would be very sorry to be obliged to engage in farming to the south of it.

Another authority states that the area of land which is used for farming and grazing purposes in the Dominion at the present time may be set down at 50,000,000 acres and that a conservative estimate would place the area available for these purposes at six times this amount, that is to say, 300,000,000 acres or 470,000 square miles. This smaller estimate, which includes not only farming but grazing land, is probably too low but nearer the truth.

But we do not require to resort to exaggeration to convey an adequate impression of our immense wealth in agricultural lands. We certainly have in Canada abundant land to support a population of many millions—a people who will be not only numerous but who should have that sturdy manhood which has always characterized the hardy populations of northern countries.

If, however, this great heritage is to be transmitted to succeeding generations of Canadians unimpaired, we must improve our methods of farming and follow the example set by other countries from which we have now much to learn. Good land will support a dense population and can be made to do so without losing its fertility, but only by intelligent and intensive cultivation. The greatest farming community in the world is that which lives on the rich delta lands of central and southern China. Prof. King, of the University of Wisconsin, who when in China made an exhaustive study of the methods of farming there adopted, has reported that these people have, during the long series of centuries in which they have tilled the land, developed such a perfect system of agriculture that he could see no way in which western science could materially aid them. Through these long ages, while they have made the land yield enormous crops, they have maintained its fertility unimpaired.

But what has been the experience of the United States, which is our nearest neighbour and the one whose fields are contiguous with ours ?

If we take the wheat crop, using it merely as an index of yield, we find that large crops of this grain used to be grown in the east. A recent bulletin of the federal Department of Agriculture tells us

that "Wheat was successfully produced in central New York for something like 40 years. During the latter part of that period the yields began to decline, and at the end of another 20 years, they were so low that exclusive wheat growing became unprofitable. Ohio, Indiana, Illinois and Iowa have each in turn repeated the history of New York. The soils of these states were productive in the begining, and it required 40, 50 or 60 years for the single crop system to materially reduce the yields."

Now in the east we find in many regions abandoned farms with farm houses in every stage of decay. The average yield of wheat in New York State as recently as 1898 was 21·2 bushels per acre; in 1907 it was 17·3. In the same short time the average yield in Indiana fell from 15·6 to 14·4 bushels; in Minnesota from 15·8 to 13; in North Dakota from 14·4 to 10; in Oklahoma from 14·9 to 9.

As has been remarked by Mr. Hill, "instead of preserving the fertility of their lands, the farmers have gone in search of new soils to be skinned, robbed and abandoned as soon as the old showed signs of exhaustion. Now that they have reached the jumping-off place, there is no longer any 'west' to move into."* The direct interest which this has for us lies in the fact that there being no more "West" to move into, the stream has turned north and is now moving into the Canadian Northwest.

We have here an illustration of the truth of Lord Bacon's observation that "The principal thing that hath been the destruction of most plantations hath been the base and hasty drawing of profit in the first years."

The Committee on Lands of the Canadian Commission of Conservation under the able chairmanship of Dr. J. W. Robertson is now carrying on an agricultural survey of the Dominion. They visited and examined, in 1912, 1212 farms in the several provinces of the Dominion, and while in the eastern provinces, speaking generally, from 25 to 50 per cent of the farmers showed an increase in the yield of their farms during the past 10 years; of the 100 farms examined in Manitoba not one farmer reported an increase in the yield per acre and 46 per cent reported an actual decrease. This decrease, as Dr. Robertson remarks, must be concurrent with exhaustion of fertility.†

This decline in fertility with impoverishment and impending exhaustion of the soil is due, of course, to the growing of a single crop or to other bad practices in farming.

The land on the western prairies and many other parts of Canada and the United States is at the present time being mined, not farmed.

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*Highways of Progress, p. 78.

†Annual Report, Commission of Conservation, 1912, p. 59.

Base map from plate of Dept. of Interior map

In Manitoba the deep black soil is very rich and is being exhausted slowly, but the lighter land of Saskatchewan and eastern Alberta will be impoverished more quickly, and the more rapidly the population pours into this western country, the more rapidly will this result be attained. The progressive exhaustion of the lands of the western provinces under wheat cropping is probably the greatest problem in conservation which faces the Canadian people at the present time.

It is only by cultivating an amount of land which they can care for properly, by adopting a proper system of rotation of crops and by applying to the land suitable manures, either natural or artificial, that the fertility of our lands can be maintained by the farmers.

In view of these facts, it is a matter for sincere congratulation that in parts of Manitoba and Alberta, as well as in our eastern provinces, more attention within the last few years is being given to mixed farming. It is to be noted as a favourable sign that within the past two years serious attention is being paid to the raising of hogs, 100,000 of these animals having this year been shipped to the United States in addition to those sent to the Canadian factories. Every possible effort, however, should be made to carry instruction to the farmer and to demonstrate to him the importance of caring for his land. Something is now being done in this direction by our agricultural colleges and by the Commission of Conservation, and much has been done by the Federal Government through the Department of Agriculture. It is to be hoped that the great grant of $10,000,000 now being expended by the Government for the advancement of agriculture in the Dominion may, in part at least, be applied to the education of our farming population in the underlying and everlasting principles on which a sound system of agriculture is based.

Forest Products. (Timber, Pulp-Wood, &c.)

The forests of Canada were its chief source of revenue in the early days of the settlement of the country. Year by year the great rafts of timber were floated down the St. Lawrence and Ottawa rivers past Montreal and were loaded on fleets of ships at the port of Quebec.

Later, with the advent of railways, the lumber was brought in immense quantities by rail to Montreal or shipped directly to its market in the United States.

The following figures, represented graphically in the accompanying diagram, show the yield of products of the forest (wood) annually for census years going back to 1870, expressed in feet, board measure:—

	Feet board measure.
1870	2,951,134,352
1880	6,174,605,544
1890	5,529,993,716
1900	4,131,702,968
1910	5,696,537,260

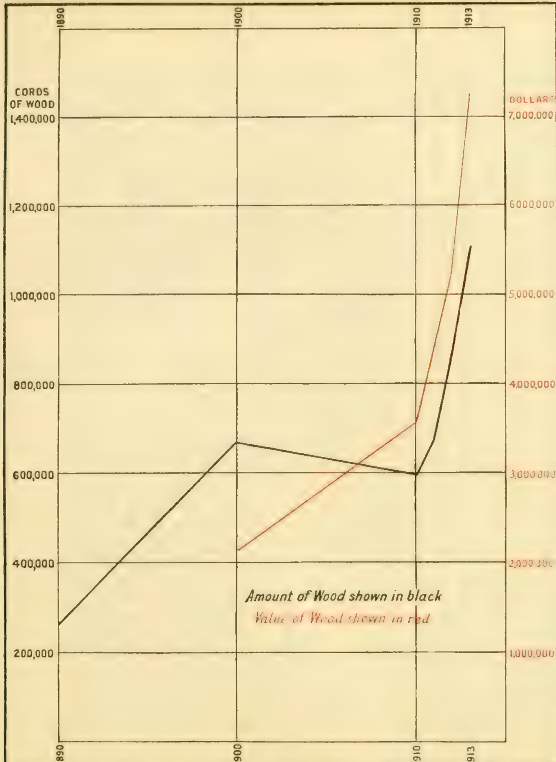
These figures have been compiled for me from the census returns by Mr. Leavitt, the Chief Forester of the Commission of Conservation. They comprise the output of square, waney and flat timber, logs for lumber and pulp wood. Such products as cord-wood and fence posts are not included owing to the fact that the statistics for these must necessarily be very largely conjectural, and also owing to the fact that for purposes of comparison their inclusion would be unsatisfactory in so much as no figures whatsoever are given for such products prior to the census of 1890.

Notwithstanding this continuous drain upon our forests and the tremendous losses which they have sustained by fire, the general opinion of the people of Canada, an opinion to which from time to time expression is given in the utterances of our public men, is that the great northern forests of Canada are so extensive that they are practically exhaustless and will afford an abundant supply of timber for all future time, a supply which will not only meet our own needs, but will be amply sufficient to make good the increasing demand of the United States, due to the disappearance of its own forests, and also afford a surplus for export to Great Britain, South America, the West Indies and other countries as at the present time.

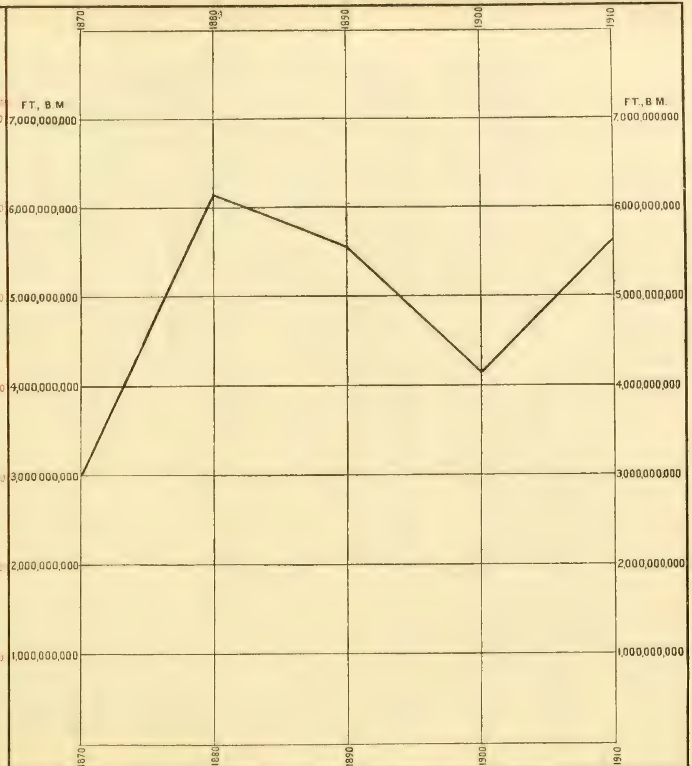
A closer examination of the facts of the case obtained by investigations carried on during recent years, however, reveals a number of interesting and very important results. The accompanying map, based upon one prepared in 1906 by James White, then Dominion Geographer, shows the nature and extent of the forests of Canada.

It is only in these portions of the Dominion which are shown to be covered by the "Southern Forest," the "Northern Forest, densely wooded," and in British Columbia that there are forests yielding merchantable products. Furthermore, it must be noted that the "Northern Forest" is composed chiefly of trees of less value than the "Southern Forest," which has up to the present time been the chief source of the timber supplies of eastern Canada.

A careful study of the question by the official forester of the Dominion shows that so far from being exhaustless the reserves of merchantable soft timber in the forests of Canada are only between $\frac{1}{4}$ and $\frac{1}{5}$ of that remaining in the forests of the United States. Of



AMOUNT AND VALUE OF THE WOOD ANNUALLY MANUFACTURED INTO PULP IN THE DOMINION OF CANADA



TOTAL OUTPUT OF FOREST PRODUCTS IN THE DOMINION OF CANADA

these reserves in Canada, about one-half is in the old provinces of eastern Canada and the other half in British Columbia. The evidence goes to show that at the present rate of cutting the supply of timber will within a comparatively few years be sufficient only for the needs of the Dominion itself, leaving no surplus for export. A forest survey of the province of Nova Scotia by Dr. Fernow has shown that in that province, if the saw mills which are now at work continue in operation with their present output, the merchantable timber will be entirely exhausted in the next 20 years. In 1895 the Dominion Statistician stated in his report that "the first quality of pine has disappeared" and that "we are within reasonable distance of the time when with the exception of spruce as to wood and British Columbia as to provinces, Canada shall cease to be as now an exporting country."

It must be borne in mind that while a large part of Canada is covered with forest, much of this is a woodland country rather than a country covered with a forest which produces considerable supplies of merchantable timber. Furthermore, the practice which has been followed of cutting out the valuable kinds of timber has left the successively poorer and inferior species of trees—"tree weeds," as they have been called—to multiply without restraint, and thus the forest gradually changes its character and deteriorates in value. Moreover, the rivers draining the northern forest flow down to Hudson's Bay, so that the logs if floated down the streams would reach that body of water instead of the St. Lawrence or the Great Lakes. With the approaching exhaustion of the reserves of standing timber, there has sprung up within the past few years a demand for pulpwood, to supply which the younger and smaller trees are taken and ground up for the manufacture of paper. Fortunately this is not necessarily so fatal to the continued existence of our forests as might be supposed, for the younger trees, if properly cared for, grow in relatively few years to the size required for pulp-wood. Thus, if the limits over which a company cuts its supplies are large and properly cared for, they can be made to produce a continuous supply of wood for the pulp mill. Our great water powers adjacent to the supply of raw material should make this pulp and paper industry a permanent source of wealth to the Dominion.

The growth of the pulp industry in Canada is set forth in the following table and is shown graphically in the accompanying diagram. In addition to the wood cut in Canada for the manufacture of Canadian pulp, a very large amount is shipped to the United States and there ground into pulp.

	Cords of wood used.	Value of wood in dollars.	Tons of pulp produced.
1890	261,110		
1900	668,034	$2,168,509	
1910	598,487	$3,585,154	474,000
1911	672,288	$4,338,024	496,833
1912	866,042	$5,215,582	682,632
1913	1,109,034	$7,243,368	

Our forests, then, are not inexhaustible. They have already been much injured and the eastern forests are now greatly depleted, and their condition is becoming worse year by year.

Such being the situation, is it not possible to adopt some course of action which will conserve our forests and make them a permanent source of industry and wealth for succeeding generations?

In the first place, we must recognize that the conservation of our forests does not mean that they shall be locked up. We must all agree with Dr. J. W. Robertson, when he says: "I have no sympathy with people who would reserve our forests for our descendants. Conservation means taking the largest toll out of these revenues now and leaving them not only unimpaired but extended and improved by wise use, using the annual production, but not destroying or reducing the source of supply."

Let us see what other nations have done with their forests.

The facts concerning these have been admirably presented by Dr. Fernow in his "History of Forestry." I cite a few of them, giving only the financial results, seeing that the objection generally urged to the proper care and preservation of our forests in Canada is that it would not pay.

The Prussian forests in 1830, when systematic management had been applied only for a short time, yielded a net revenue of 44 cents per acre; this, by careful cultivation of the forests, had grown by 1907 to $2.52 per acre, that is to say, there was an improvement in net results annually of 2¼ per cent compounded, while the principal—the forest—was continually improving. Thus Prussia, from an acreage which is about one-half of the area now under license in Ontario, derives annually at least seven times the net income obtained from the forests of Ontario, and that not by depleting its capital as Ontario does, but merely taking the interest in annual growth; moreover, the capital is continually increasing in value.

In Saxony, with somewhat less than half a million acres of state forest—mostly spruce—but most intensively managed, the net revenue has increased from 62 cents to $6.00 per acre, this state in the

Land originally forested, but burned over and washed away until the stony sub-soil is exposed. This particular location has been homesteaded. Crows Nest District, Alberta. (From Forestry Branch, Department of the Interior).

Good forestry practice. The forest as a resource perpetuated by wise use. Fire damage minimized by proper brush disposal. A future stand of merchantable timber assured by preservation of young growth.

Plate A.

last 50 years having taken from its small forest area, wood and wood products to the value of $200,000,000 without impairing its producing power.

France has in the last 60 years reclaimed 2,300,000 acres of absolutely waste land by forest planting at an outlay of $15,000,000. These areas are now estimated to have a value of $135,000,000 and furnish annual crops which sell for $10,000,000, a yield of 67 per cent per annum on the initial outlay.

One country after another in Europe has come to recognize the necessity of substituting proper management of its forests for ruthless exploitation, the last to fall into line being Sweden and Russia, the net income derived by the latter country from the 300,000,000 acres of state forest which are actually worked being about $30,000 000 per annum.

The revenue from the forests of British India under the administration of the Indian Forest Service amounted last year to $14,000,000. Over one and a quarter million dollars were derived from the sale of minor produce other than timber and a similar amount was obtained by leasing grazing privileges in these forests.

In the United States also there is now a regularly established forest service with great government forest reserves. These are being increased from time to tome. At the close of Mr. Roosevelt's administration they had an area of 175,000,000 acres. In 1910 the government set aside the sum of $10,000,000 to purchase additional forest reserves in the White Mountains and in the southern Appalachians.

In all the European countries and in India some of the forests are owned by the state, some by municipalities or communes and some by private persons. The forests owned by the different German states represent about 33 per cent of the total forest areas, while in Russia the government owns 62 per cent and in Sweden 35 per cent of the forests. Speaking generally, it is found that the state-owned forests are the best, the most efficiently managed and the most productive.

State ownership is the most suitable owing to the long time—60 to 120 years—which is required to bring the depleted forests into a permanently productive condition, which naturally discourages private enterprise. Since most of the forests in Canada are owned by the governments, it should be a comparatively easy matter to change our present methods of dealing with our forests and replace them by much more efficient ones. Only two reasons for hesitation can be put forward—firstly, that any change may interfere with private operations, and, secondly, that the expense entailed would be very great.

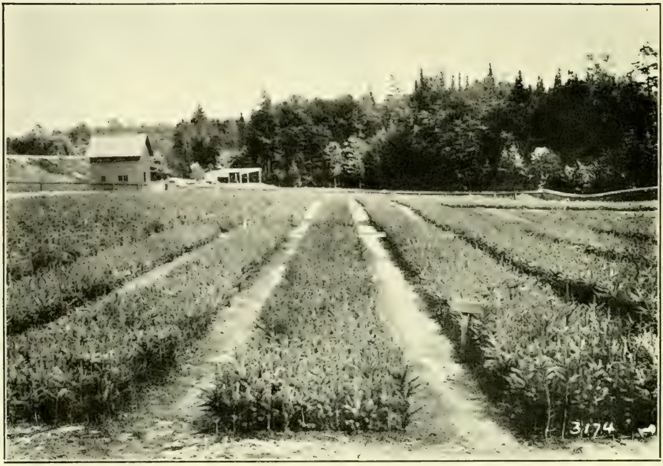
In reply to these objections it may be said that there are now enormous areas of land standing waste, that is to say, they are either destitute of trees or growing trees which are of no value. If the governments were to secure certain of these areas and cultivate forests on them by following the well known principles of forest practice worked out and proved to be so efficient and effective in every country in Europe, they would not only be establishing a profitable investment for public funds but would present to private owners a striking example of what can be accomplished by the application of knowledge to industry. We are assured by a forester of no less experience than Dr. Fernow that with the present stumpage of white pine in Canada, the cost of planting can be covered and a return of at least 4 per cent compound interest can be obtained, while other kinds of wood are fast reaching a value which would well repay the cost of reproduction.

Such forests of choice pine or other woods, which are each year becoming more difficult to secure, would 75 years hence be of enormous value both as a source of revenue to the Government and of wood supply to the people of the country.

But in addition to supplying timber, the forests of a country play two other very important roles: namely, that of equalizing the flow of rivers and of preserving the land itself from being washed away in times of heavy rain.

Beneath the trees of a forest a thick mantle of leaves and twigs covers the ground. These rest upon humus produced by the decay of leaves which have fallen in former years and which is very porous. This material, sheltered from the sun in the shadow of the forest, is like a sponge which is capable of absorbing several inches of rainfall, which is allowed to escape only very gradually.

When, therefore, the forest cover is preserved on the gathering ground or catchment-basin of rivers, the rain falling on this forest area drains away very slowly into the brooks and streams, which tends in a very marked manner to equalize the flow of the rivers and to lessen the dangers of floods. In the deserts of Arizona, where the forest cover is wanting, within twenty minutes of the first muttering of the thunder presaging a sudden cloud-burst, the rain falling on the surface and draining off immediately into one of the tributaries of the Colorado river, will change this from a narrow stream into a raging torrent thirty or forty feet deep, filling the canon from wall to wall, and the stream after remaining in flood for a short time will subside again with equal rapidity. This is merely a rather striking illustration of the fact that the lack of forest cover on the drainage area of a river causes the river to run with a very uneven discharge, at one time in violent flood and



Nursery of young Norway Spruce for re-planting deforested areas, Saranac Lake, Adirondack Mountains. (From Forestry Branch, Department of the Interior, Canada.)

Burned area replanted with young trees. Saranac Lake, Adirondack Mountains. (From Forestry Branch, Department of the Interior, Canada).

Plate B.

at another with greatly reduced volume. This leads not only to great destruction by floods in the lower reaches of the stream at certain seasons of the year, but it greatly decreases the value of the water powers along the course of the river, since the number of horsepower which can be utilized in the case of any power development is that which can be supplied continuously throughout the year, that is to say, speaking generally, the amount of power supplied by the stream at low water. Our water powers in Canada are so numerous and so valuable that anything which tends to destroy them must be regarded as a national peril.

To protect some of our more important streams the Dominion (or Provincial) governments have set aside certain large areas about their head waters as permanent forest reserves or national parks. These areas in recent years have been greatly increased upon the recommendation of the Commission of Conservation. The total area of the Dominion forest reserves at the present time is 35,804 square miles and the total area of national parks in Canada is 4114·5 square miles. In the forest reserves no land can be taken up for settlement, and the forest cover will be permanently preserved, while in the national parks the game is also preserved, so that they become sanctuaries for the wild animals of the country. One of the most important of these forest reserves is that on the eastern slopes of the Rocky Mountains in Alberta, which will not only protect the catchment areas of the rivers flowing through the great plains but will also supply timber to the future population of this great district. This action of the Government is worthy of all commendation. Other reserves should be added to those which have been already set aside, as, for instance, the tract about the head waters of the Winnipeg River recently recommended by the Commission of Conservation, the area being one which is unfit for settlement but of great importance in connection with the equalization of the flow of this river on which such enormous water powers are now being developed and which have such an important bearing on the welfare and future of the province of Manitoba.

It is, however, of the utmost importance that the Government should be supported by a strong public opinion in providing for a really effective administration of these great reserves, so that the laws enacted for their maintenance shall be properly enforced.

Again, areas from which the forest cover have been removed, leaving the soil exposed—especially if they be on hill or mountain sides—are often reduced to perpetual barrenness by the washing away of the soil, leaving the bare rock exposed, on which there is no foothold for vegetation. Whole districts on the western slopes of

the French Alps have been devastated in this way and the population forced to leave, their farms having entirely disappeared.

Widespread devastation from this cause is also seen in China, where the wood cutters, in search of fuel for the dense population of that teeming land, in past ages completely stripped the forest cover from the hill slopes over great areas which are now deserts.

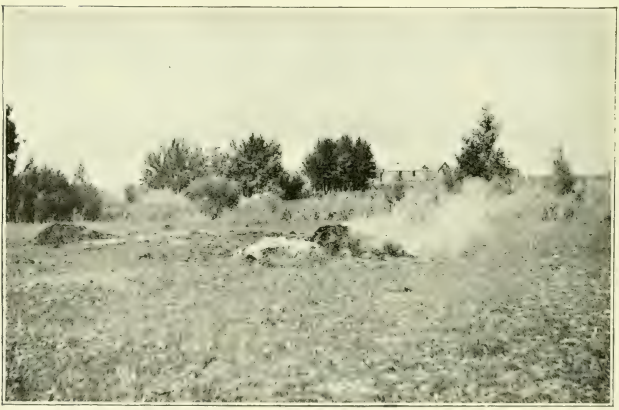
This destructive process is going forward very rapidly in the southern Appalachian region of the United States. The Secretary of Agriculture of the United States has stated that in 1901 the damage wrought in this region from this cause amounted to $18,000,000, and Governor Glen in his address to the White House Conference in 1908 stated that the loss year in and year out might be estimated at from seven to eight million dollars.

Prof. Shaler says that a field lying at an angle of twenty degrees can be totally destroyed in a hundred plowings, and he estimates that in Kentucky, where cultivation is hardly more than a century old, one tenth of the arable soil has been destroyed and that a considerable portion of this cannot be restored in any way. This danger is especially threatening on the steep mountain slopes in British Columbia, where the soil, if stripped of its forest cover by the axe or by fire, will be exposed to the same destruction as has been experienced elsewhere.

Fortunately an interest in the preservation of our forests is being awakened in Canada and certain steps are being taken toward this end.

One of the most widespread causes of destruction has been forest fires. The railroads have been a very active agency in starting such fires. The Railway Commission have made a regulation governing all the roads under their control to the effect that the roads are responsible for any forest fires started by their trains in the districts through which they run and that any fire which has started or is found burning within 300 feet of their tracks will be considered as having been originated by their trains. This has led to a very careful patrol of the railway lines, especially where these run through forest lands, as for instance in Alberta and British Columbia. The locomotives running over some 587 miles of the railways on the Canadian Pacific Railway in British Columbia have been equipped to burn oil instead of coal, which greatly reduces the danger of starting fires in the adacent forests. All the railways have made provision by appointing special officers to carry out the orders of the Canadian Board of Railway Commissioners and to co-operate with the officers of that body and of the federal and provincial forest departments.

Drifting sand advancing over cultivated land, Lachute, Que.



A common western method of disposing of stable manure. This method will not maintain the fertility of the soil nor will it increase the regard of posterity for those who practise it.

PLATE C.

In British Columbia a survey of the forest lands is in progress and lands desired for settlement must be examined by the Forest Board and declared suitable for settlement before any grant is issued. The timber lessees pay a certain tax per acre to which the Government adds an equal amount, and these payments constitute a fire protection fund with which, during the year 1913, 415 fire rangers were employed in addition to 60 engaged by the railways. Many miles of road and fire lines were cut through the forests and look-out stations, as well as 529 miles of telephone line for the fire protection service were constructed.

More or less effective steps are also being taken by other provinces looking to the protection of their forests from fire.

One of the most important developments in connection with forest conservation is the establishment of the St. Maurice Forest Protection Association, formed in 1912, when the companies holding timber and pulp-wood limits in this valley, recognizing that individual effort was quite inefficient, combined and organized their fire protection work into one service, placing it under an officer who should have exclusive charge of this important work. The Association has now charge of an area embracing 7,279,000 acres. It has made the whole of this area accessible to its fire rangers by cutting out over 500 miles of paths and trails and has connected all its stations by telephone. As a result, during the first year of its operations no less than 97 incipient fires were extinguished and no loss was incurred, while in the summer of 1913 which was exceptionally dry, 306 fires were extinguished, the actual fire damage amounting to less than one thousandth of one per cent of the value of the timber on the territory patrolled. More recently the Lower Ottawa Forest Protective Association Ltd., has been organized which provides for the proper patrolling of over 6,250,000 acres, or nearly 10,000 square miles of timber lands on the watersheds of the Gatineau, Lievre, Rouge, Coulonge and Nation rivers in the Province of Quebec.

The results already obtained by the St. Maurice Forest Protective Association demonstrate that by the adoption of intelligent co-operation between timber owners and Governments absolute protection against fires can be secured in the normal season.

It is hoped that the excellent examples set by these associations will be followed in all parts of the Dominion.

Other undertakings on a smaller scale which are being set on foot in various provinces of the Dominion seem an indication that the importance of preserving our forests is being realized by the people of Canada. The development of a strong public opinion supporting the Government in the appointment of properly qualified and thor-

oughly efficient persons to enforce existing government regulations is the most important factor required in the meantime to give to our forests the prominent place which they should have among the permanent assets of the people of Canada.

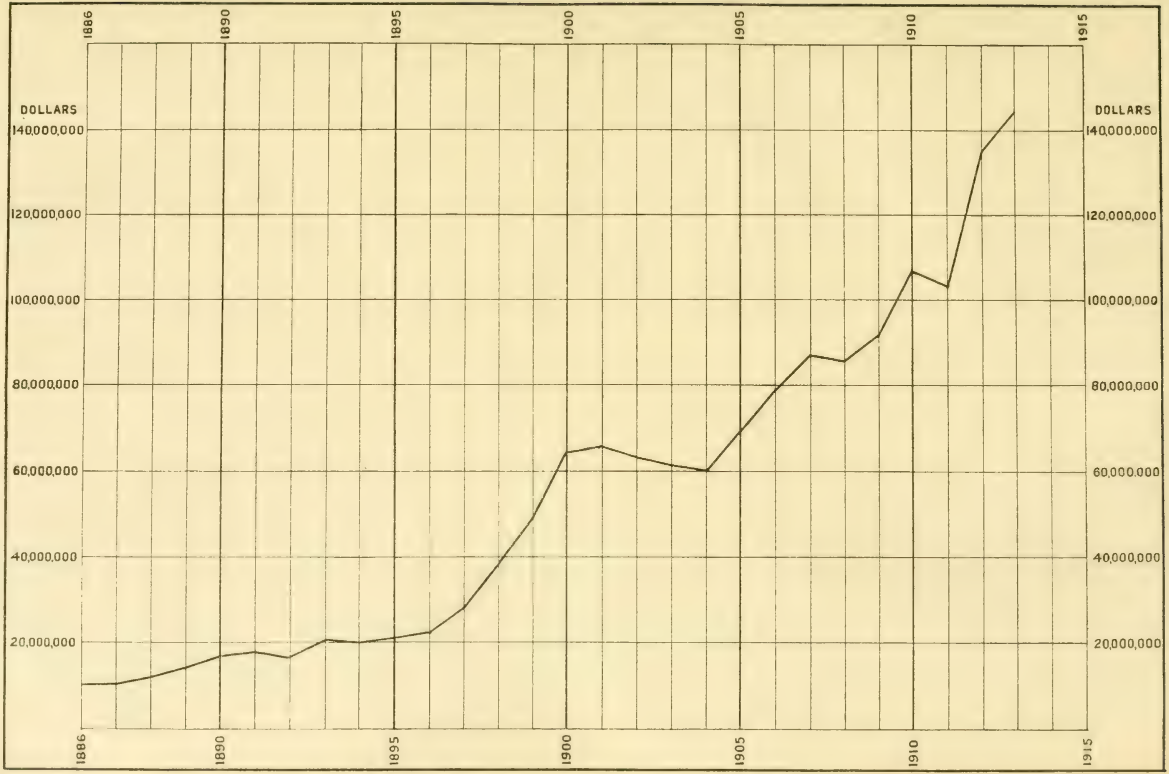
Mines.

Mining is the only industry in a country which from the very nature of the case cannot be permanent. Other industries—like money well invested—can be made to yield an annual return in interest while the capital remains unimpaired or even increases in value.

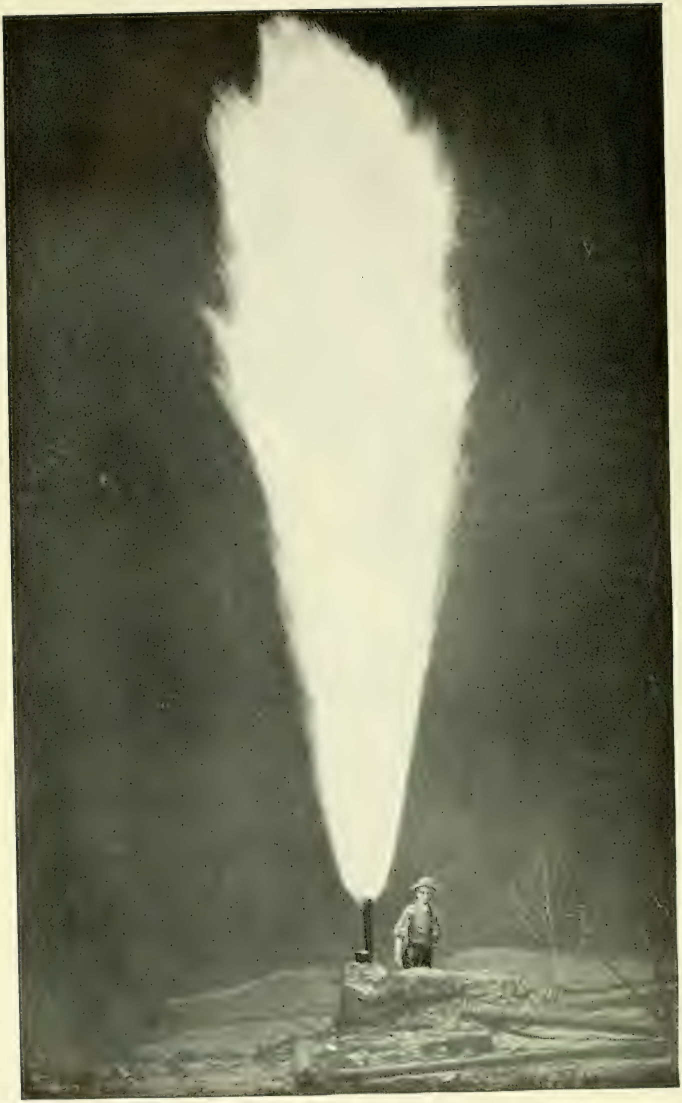
The mineral wealth of a country may be compared to a sum of money hidden in the ground. It does not renew itself and every dollar abstracted leaves just so much less for future use. "Yet it is a singular fact," as remarked by a recent writer referring to the United States, "that among a people supposedly grounded in the rudiments of political economy, the progressive exhaustion of this precious resource is everywhere heralded as a triumph of enterprise and a gauge of national prosperity. The nation publishes periodically the record of its scattering of assets never to be regained and waits with a smile of complacence for general congratulation."

Great mining regions in the older countries of the world worked for many years have now become exhausted. Among these may be instanced the Kongsberg Mines in Norway, which at one time produced great masses of native silver rivalling those now obtained from Cobalt; the lead mines of Great Britain, now completely abandoned; the celebrated mines of the region about Freiberg in Saxony, worked continuously since A.D. 1160, the last of which is now about to be closed down; and the great diamond fields of India, which no longer yield these precious gems.

In modern times with the introduction of high explosives and modern machinery, the exhaustion of any mineral deposit is much more speedily attained than with the cruder appliances of former times, and while under these modern conditions some of our great mining camps, as for instance that of the Sudbury district, will continue to yield an enormous output for many years or perhaps decades yet to come, others, such as the Cobalt district, have already passed their time of maximum yield, and the output while still very large is falling off. In the United States the anthracite supply is approaching exhaustion which is a fact of portent not only for the people of the United States but also for the people of eastern and central Canada, for all our supplies of this most valuable fuel are drawn from the mines of Pennsylvania.



ANNUAL PRODUCTION OF MINERALS IN CANADA



Natural gas from boring at Pelican Portage, Athabasca River, Alberta. This has been burning since 1897, the waste during these 17 years having been enormous. It is 20 miles nearer to Edmonton than the Bow Island wells are to Calgary, but Edmonton is not yet supplied with natural gas.

PLATE D.

The discovery and development of mining regions, however, even although these must be exhausted in time, is often of the greatest importance to a community and in the earlier stages of its development bring about the opening up and settlement of remote tracts of country which subsequently develop other industries.

In Canada our mineral deposits are of great extent and importance. The value of the mineral output is increasing rapidly year by year as shown in the accompanying diagram Our coal resources, as shown by the investigations undertaken in connection with the International Geological Congress which was held in Canada last year, are in extent second only to those of the United States. The geological structure of the Dominion, moreover, is such as to lead to the confident belief that as detailed exploration is carried forward in northern Canada, large deposits of the metallic minerals will be found in that portion of the Dominion—so that the mining industry of the Dominion, there is reason to believe—will play a very important part in the future history of the country

It is, however, of the greatest importance that we should avoid all waste in the development of these resources. The losses sustained in other countries from lack of care and thought in this respect are enormous. Dr. Douglas estimates, for instance, to take only one example, that at the Rio Tinto mines in Spain in a period of some thirty years through the unskilful treatment of the ore, about 7,000,000 tons of sulphur, valued at not less than $70,000,000, were wasted, while with modern improvements in the method of handling the ore, about 1,000,000 tons of sulphur are annually saved to the world which would otherwise have been burned and served simply to pollute the atmosphere. The same writer points out that only some 60 per cent of the hundreds of millions of dollars yielded by the Comstock lode was recovered at the time and at first the enormously rich tailings were not even collected, such was the haste of the miners to empty that stupendous deposit which should have made Nevada prosperous for generations instead of whirling the whole country into a mad dance of reckless speculation.

The primary cause of a large part of this waste is over-capitalization, which involves a large output at any expense if the value of the shares is to be raised and their price maintained. Over-capitalization generally demands over-production which in its turn almost invariably involves waste at some stage of the progress of the metal from the mine to the consumer.

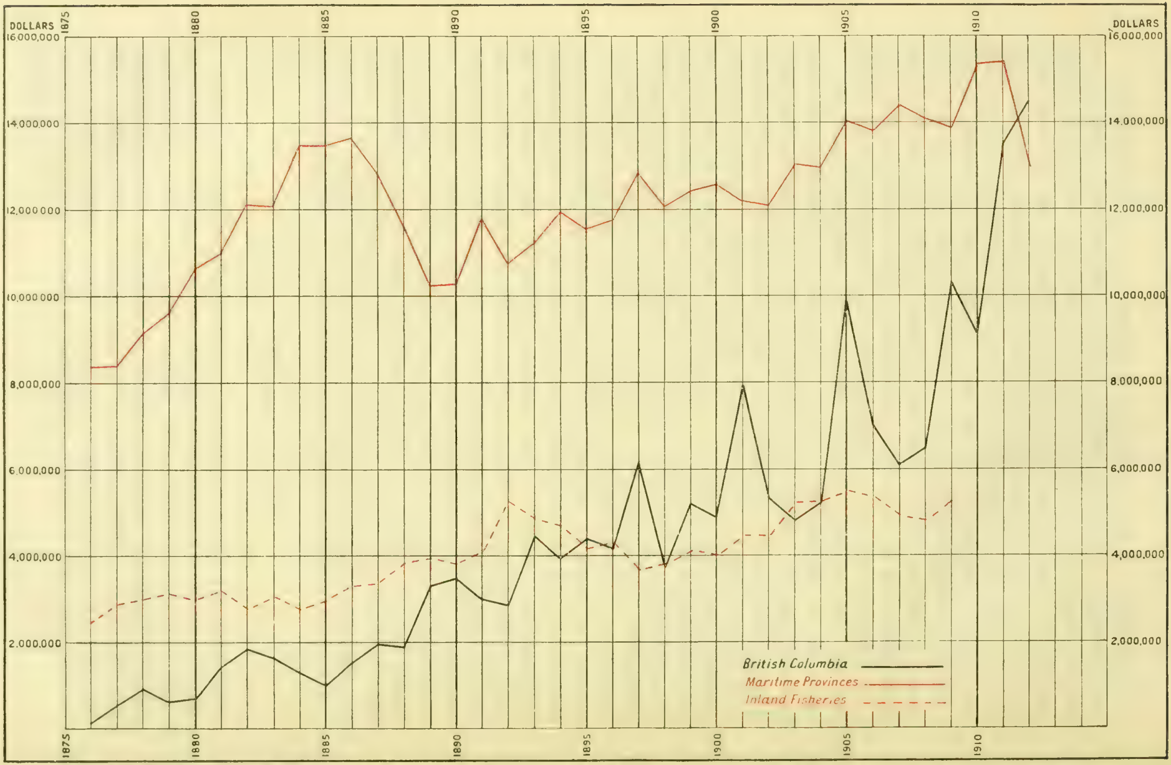
Perhaps the most serious waste which is taking place in the Dominion at the present time in connection with its mineral resources is presented by the mining and utilization of coal.

In the first place, in mining a coal seam from 50 to 90 per cent of the coal is left in the workings for the purpose of supporting the roof. Of the coal which is taken out and burned under boilers in the usual manner, only about 12 per cent of the total energy is developed. That is to say, we secure for useful purposes only about 5 per cent of the total energy contained in the coal occurring in the area. If the coal is burned in gas producers and the gas so obtained used in internal combustion engines, these having a higher efficiency develop about 30 per cent of the energy in the coal actually mined, or about 12 per cent of the energy locked up in the coal of the whole area. This is an improvement but still represents an enormous waste.

On the other hand, the coal may be mined for the production of coke for metallurgical purposes. About three-fourths of the coke produced for this purpose in North America and all the coke made in western Canada is manufactured in Bee Hive furnaces, which yield a relatively low percentage of coke while the other products of the coal —gas, tar, ammonia, benzol, etc.—go to waste. All these products may be saved by making the coke in by-product ovens, representing in localities where the surplus gas can be sold at a reasonable rate, a gain which is estimated by Mr. F. E. Lucas, manager of the coke ovens of the Dominion Coal Company, at $1.98 per ton of coke made. This figure will of course vary with the locality in which the coke is produced, but it emphasizes the great saving which may be effected by the use of the modern by-product oven. The tar and ammonia obtained by this process, moreover, meet with a ready market. The former is already being used extensively in the Dominion for a variety of purposes, among them, as a binding material in the manufacture of briquettes from slack coal, thus enabling this waste product to be successfully utilized, while the ammonia is a fertilizer of the greatest value, for which there is a great demand abroad and for which an ever-increasing demand will arise in Canada as the necessity of employing improved methods of agriculture is brought home to our farmers.

Fisheries.

Not only is Canada richly endowed with natural resources which have their locus upon the land but she is bounded on three sides by the salt waters of the sea and running through her domain are many streams and great rivers which have their origin in thousands of inland lakes, some of these being among the largest bodies of fresh water in the world. These waters abound—or should abound—in fish and other living creatures which constitute another of our great natural resources.



ANNUAL PRODUCTION OF FISHERIES OF BRITISH COLUMBIA, MARITIME PROVINCES AND INLAND FISHERIES OF CANADA

Canada ranks fifth among the nations of the world in the yield of its fisheries, in which it is estimated that 90,000 men are engaged, whose labour yields from 26 to 33 million dollars annually.

The fishing industry at the present time is carried on in three distinct and separate portions of the Dominion:—

The Atlantic Coast,
The Coast of British Columbia,
The Inland Waters.

There are also the oyster and lobster fisheries of the Atlantic coast and the fishing or rather hunting for whales, walruses, porpoises and other sea animals on the Arctic shores of Canada, and in the waters of Hudson's Bay and of the Gulf of St. Lawrence.

"It may be justly claimed," says Mr. J. J. Cowie, "that no fishing grounds in the world are so favourably situated or so well adapted for the maintenance of the most valuable varieties of commercial fishes as those on the Atlantic coast adjacent to the shores of Nova Scotia, New Brunswick, Prince Edward Island and Quebec. The cold Arctic currents which flow over the many submarine plateaus situated in the north Atlantic within easy distances of the shores bring with them vast quantities of the finest fish food and produce a temperature most suitable for the life and growth of the great commercial fishes; while the enormous numbers of bays and large inlets—veritable breeding places—into which flow great rivers full of anadromous fish life, contain abundant supplies of food for the attraction and sustenance of all kinds of salt water fishes. From whatever view these magnificent fishing waters are regarded, whether as a means of providing and maintaining a distinct industry, such as breeds hardy, skilful seamen, or as a means of supplementing the earnings of those dwellers by the seashore who engage in the necessarily limited cultivation of the soil, they present themselves as a splendid heritage, which forms one of our finest natural resources."*

On the Atlantic coast there are the deep-sea fisheries conducted on the "banks" which lie between the in-shore area and the deeper waters of the Atlantic yielding cod, haddock, hake and halibut, and the inshore fisheries carried on from one to fifteen miles from land, yielding in addition to these species, herring, mackerel, pollack, shad, flounders, sunfish, smelts, sardines and many other fish.

During the fifteen years, from 1870 to 1885, a steady advance was maintained in the value and importance of our Atlantic fisheries. In the first mentioned year the value of the catch was $6,312,409,

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*See "Sea-Fisheries of Eastern Canada." J. J. Cowie, Commission of Conservation of the Dominion of Canada, 1912, p. 94, and "The Atlantic Fisheries"—"Canada and its Provinces," p. 561.

while in the last mentioned year it rose to $14,780,584. During the next twenty-five years, from 1885 to 1910, however, little or no progress was made, the aggregate value of the catch in 1910 showing an increase of but $834,900 over that of 1885. The number of fishermen engaged in the industry rose from 27,385 in 1870 to 51,498 in 1885; but this number was increased by only 685 during the succeeding quarter of a century.

While the aggregate value of these fisheries has stood still for a quarter of a century, there have recently been some indications of a new advance. This lies in the development of a trade in fresh fish in addition to that in salted fish which, up to the present time, is the only form in which these fish have been marketed. In order to meet the demands of this trade, the fishermen must bring their catch to land in the shortest possible time and as a result no less than 2,304 boats of the fishing fleet have been fitted with gasoline engines and can thus land their fish in spite of head winds or calms.

Since 1908 steam trawling, the latest and most successful mode of capturing large quantities of fish ever put into operation, has been tried in a small way on the coast of Nova Scotia.

With the increasing application of modern methods arises the question: Will the vaunted abundance of fish in Canadian waters remain unaffected? This question can only be answered by a study of the records of the fisheries of European waters, where steam trawling has been carried on so long, and where the fleets are so large. There, in the comparatively narrow North Sea, what would in Canada be called excessive fishing to a superlative degree goes on from January to December, year in and year out, by an immense fleet of trawling and other steam vessels without let or hindrance except within the three-mile limit.

I would point out here, that climatic conditions in Canadian waters provide a natural protection against depletion. For three or four months in each year there is an enforced close time, during which little or no fishing takes place, and during which even the operations of steam trawlers would be brought to a stand-still, owing to the severity of the weather. Indeed, the Gulf of St. Lawrence—that immense fish-breeding area—is virtually closed to fishing from December to May, which period covers the spawning season for cod, haddock, hake and such fish.*

The fishing industry in the Maritime Provinces could be very considerably developed and be made to yield larger returns if improved methods of curing, packing and shipping were employed under proper

*See "Sea-Fisheries of Eastern Canada." J. J. Cowie, Commission of Conservation of the Dominion of Canada, 1912, pp. 107-109.

Floor of a British Columbia Salmon Cannery during a "Big run" year.

PLATE E.

Salmon Fleet, Fraser River in British Columbia. The Salmon Fishing Industry of the Fraser River is one of great value. It will probably be destroyed unless Canada and the United States can arrive at some agreement to prevent the wholesale catching of fish before they enter the river to spawn.

PLATE F

government inspection, in this way improving the quality of the salt fish sent to market. The Dominion Government has recently made an appropriation of $10,000 for the establishment of a fisheries intelligence bureau with the object of bringing before the fishermen in some concrete way information with reference to the best methods of curing and packing their fish. The Government has also made provision for the encouragement of the trade in fresh fish between the Atlantic and Pacific sea-board and the interior parts of the Dominion by paying a portion of the regular express charges on all shipments of fresh fish from the Atlantic coast to all points in Ontario and Quebec and from the Pacific coast to all points as far east as Winnipeg.

While owing to certain local causes certain kinds of fish, such as shad, are less abundant than formerly, there seems to be no indication of depletion of our Atlantic fisheries as a whole. The fact that the catch has not increased more rapidly in recent years is owing largely to a restricted market. The annual yield is shown in the accompanying diagram.

The fishing industry in British Columbia presents a marked contrast in many respects to that of our Atlantic coast. Salmon is by far the most important fish taken and it is for the most part canned for shipment. The fish are taken when coming in from the sea to spawn in the rivers and are thus easily secured. The value of the salmon catch in British Columbia has increased enormously in recent years, amounting last year to over $14,000,000. The growth of the industry is shown in the accompanying diagram.

Year by year the canneries are increasing the number and size of their plants and the number of their boats, while across the mouth of the Fraser river the nets form a veritable barricade. With such intensive fishing it can hardly be expected that the industry will not suffer. Although the run varies greatly in different years, the fish being especially abundant every fourth year, a careful study of the subject by Professor McMurrich goes to show that the supply of fish is gradually diminishing and this opinion is shared by most of the canners, although the extension of their plants is contributing all the more rapidly to the extinction of the supply. The question as to what can be done to conserve this most lucrative industry on our Pacific coast is one which presents peculiar difficulties. The salmon coming in from sea to spawn in the Fraser river pass by the coast of the United States on the south side of the Gulf of Georgia and are there taken in enormous numbers by United States fishermen. Up to 1908 the Canadian canners on the Fraser river were catching more than the Americans, but now the state of affairs is reversed and the Americans are catching

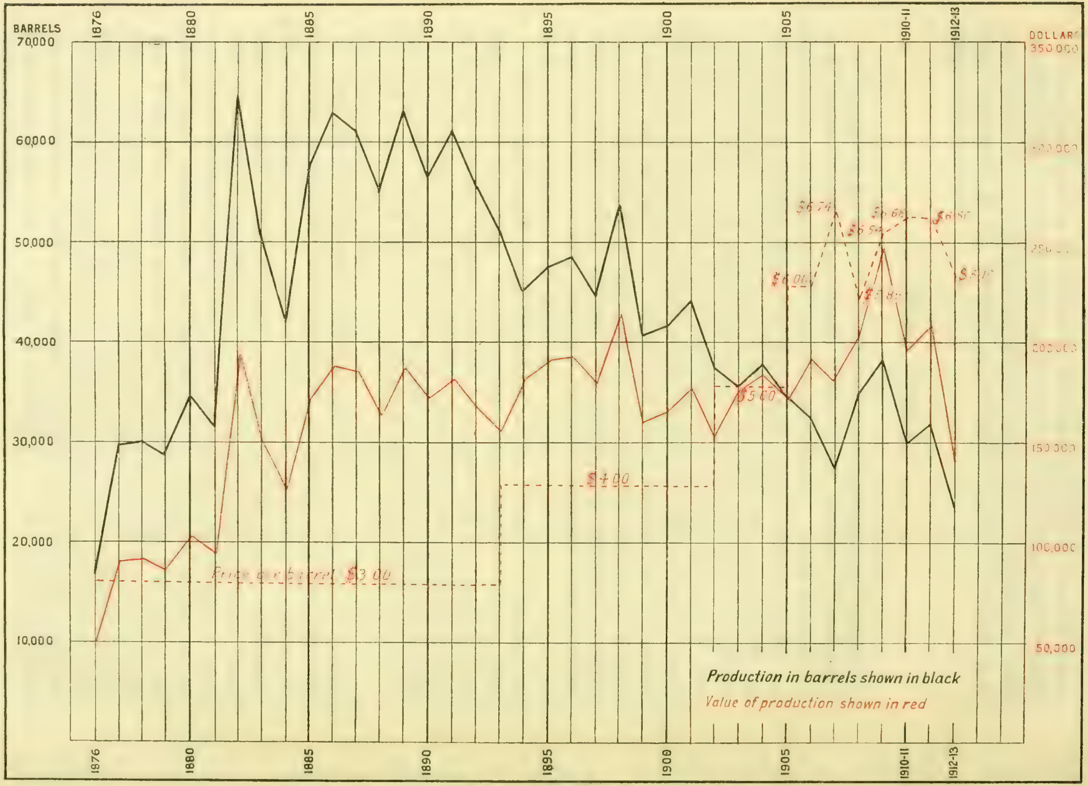
twice as many as the Canadians. The conservation of these fisheries, therefore, is an international question and one which should be made a subject of immediate consideration by the governments of the countries concerned, if the industry so valuable to both countries is to escape destruction.

Oyster Dredging.

The oyster grounds of the Atlantic coast provinces of Canada are well known as affording oysters of the finest quality. These come chiefly from the shores of Prince Edward Island. As in the case of certain of our other resources, the supply was at first supposed to be inexhaustible and the beds were ruthlessly exploited, with the result that while the output rose from about 12,000 barrels in 1875 to 64,646 barrels in 1882, and while from 1882 to 1893 the yearly production never fell below 50,000 barrels, it has now fallen to approximately half that amount, the lowest point being reached in 1907 when the yield was only 27,299 barrels. The somewhat large catch since that time is due to more vigorous fishing under the stimulus of higher prices, and not to any actual increase in the supply. The industry, in fact, is one which is fast dying out.

While the supply has been falling off, the demand for oysters has been rapidly increasing. In the 20 years from 1892 to 1912 the price of oysters on the Canadian market rose fully 223 per cent, and we are now paying to the United States over $350,000 per annum for a product which we could easily supply in sufficient amount at least for the demands of our home market if the industry were properly managed and safeguarded.

The output of Canadian oysters and the prices obtained for them in successive years are shown graphically on the accompanying diagram. The destruction of the beds has gone so far that in many areas the time has passed when simple restriction will accomplish anything—the beds must be planted anew. Not only have the beds been fished out, but the very bottom on which the oysters grew has in many places been destroyed by the farmers along the shore digging up the mud from the bottom of the bays where the oyster beds are found and even taking the oyster beds themselves for the purpose of fertilizing the soil of the adjacent land areas. This not only served to destroy the oysters thus removed, but the soft mud flowing over adjacent portions of the oyster beds which were left, killed all the remaining oysters in the surrounding area. This "mud digging" in the vicinity of oyster beds has now been made illegal.



ANNUAL PRODUCTION OF CANADIAN OYSTER BEDS

It is interesting to note that apart from the destruction wrought by man, the unfortunate bivalve has so many natural enemies that in order to maintain the normal number of oysters in any bed, each female oyster must deposit something like 16,000,000 eggs each year of its adult life. Brooks has stated that "If all the eggs were allowed to live and grow to maturity, they would fill the entire bay in a single season. The fifth generation of descendants would make more than eight worlds as large as the earth, even if each female laid only one brood of eggs." This gives some faint idea of what the struggle for existence means in the case of the oyster.

Other countries have already passed through the same experience as Canada and have found that their oyster beds which were supposed to be inexhaustible became sadly depleted by unrestricted fishing, but in every case where the Government of the country has made and enforced wise regulations, acting under competent advice, the industry has been revived. The solution has invariably been found in the cultivation of oyster beds by private enterprise. This has been the experience in England, France, Japan and the United States. In the latter country the value of the annual oyster supply is $18,000,000, of which $10,000,000 worth is derived from planted beds.

It seems, however, that a brighter future is in store for the industry in Canada. An unfortunate conflict in jurisdiction between the Dominion and Provincial Parliaments was settled in 1912, the Dominion Government waiving its claim to grant leases in the oyster-producing areas in Canada, while retaining its right to full legislative jurisdiction. The leasing of areas for the cultivation of oysters now rests entirely with the Provinces, while the federal Government makes and enforces the laws and regulations under which the oyster fishing is carried on. With the establishment of this agreement Prince Edward Island at once took steps to have its large areas suitable for oyster cultivation surveyed and subdivided preparatory to leasing them. The general line of policy adopted should not only lead to a revival of the oyster industry but will, it is hoped, develop it far beyond the highest point that it ever reached in former years and thus, as remarked by Mr. Clifford Sifton in his annual address to the Commission of Conservation last fall,—"Our friends in Prince Edward Island will probably before long be able to show the rest of the Dominion that a small province largely removed from the possibility of commercial development open to other provinces of the Dominion, is yet able, by the study of its natural conditions and the development of hitherto neglected lines of production, to attain an enviable degree of general prosperity."

What is now needed above all things is that which it is the duty of the Dominion Government to supply—a properly organized and efficient oyster protection service placed under the rules and regulations of the Civil Service Act.

Lobster Fishing.

Along the shores of Eastern Canada there are perhaps the most remarkable grounds for lobster fishing in the world. During the past forty years they have produced a greater number of lobsters than any other part of the globe.

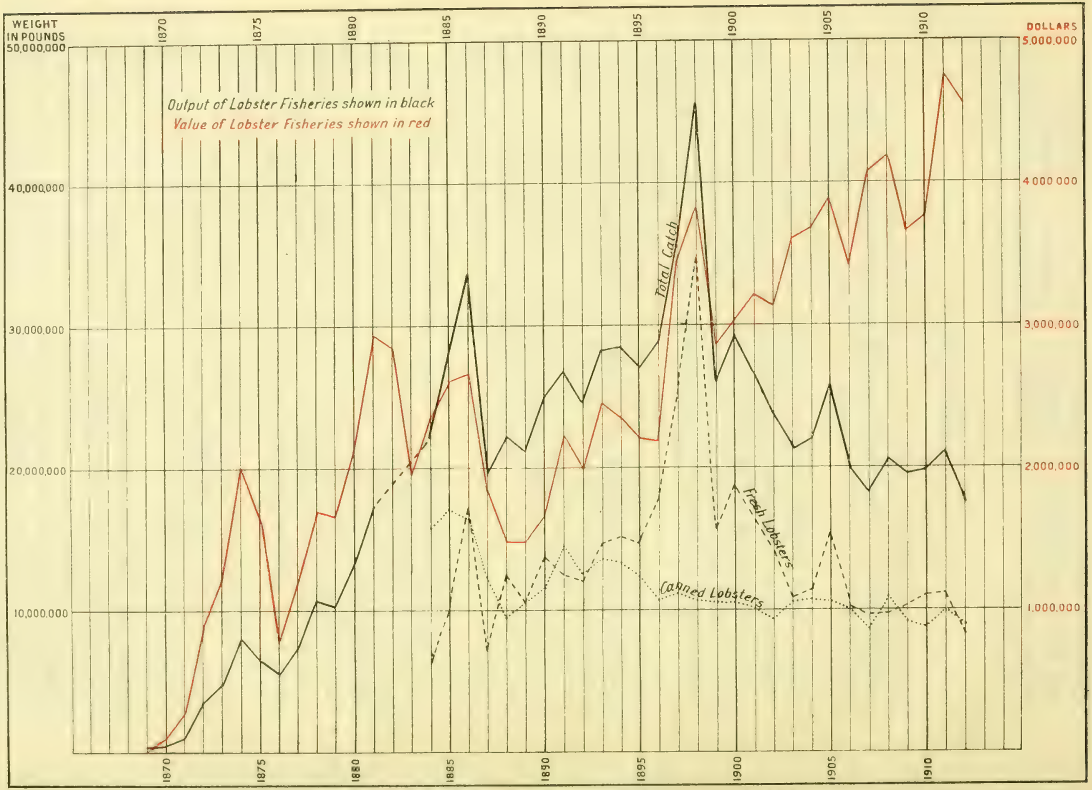
In former times and as late as the sixties, lobsters were so abundant along the whole 5,000 miles of coast between Passamaquoddy Bay and Labrador that after a heavy storm it was no uncommon thing to find windrows of lobsters stranded on the coast, and these, in the settled regions were often carted away by the farmers and used to fertilize their lands.

The canning of lobsters was started in the sixties and in 1869 61,000 one pound cans were produced; the next year the quantity increased to half a million cans, and in 1871 over a million pounds of lobsters were produced. In 1881 the output exceeded 17,000,000, when it commenced to decrease till about 1898 when the output was between 10,000,000 and 11,000,000 pounds. Since that time it has shown a further decrease, about 9,000,000 pounds being now canned annually.

In addition to the lobsters which are canned, live lobsters commenced to be exported in the early eighties, and at the present time between 100,000 and 120,000 cwts. are shipped in this form. The statistics show that there has been a considerable falling off in the number of live lobsters shipped in recent years although just to what extent this has taken place is more or less uncertain as there is some doubt concerning the accuracy of the statistics of this trade in its earlier years.

There are now nearly 700 canneries in the Maritime Provinces, representing an investment of over $2,000,000 and giving employment to over 19,000 persons. The industry is second only to that of the cod fisheries.

The Government statistics are somewhat confused, the returns in different series of years being made in cases, cans, pounds, cwts., tons, &c., as the industry developed. These I have reduced to pounds, thus making it possible to compare the annual output in successive years. These figures with value of the product plotted as curves are shown in the diagram. From an examination of the curve of production



OUTPUT AND VALUE OF LOBSTER FISHERIES OF CANADA

it will be seen that notwithstanding the ever increasing vigour with which the industry is being prosecuted, stimulated by the growing demand with rising prices, the yield is falling off. There is not only a decrease in the aggregate catch, but the lobsters now caught are much smaller. This decrease in size is always one of the first signs of the decadence of a fishery.

In the case of lobster fishing, as in the case of so many other industries based on our natural resources, when the industry was started the lobsters were so extraordinarily abundant that the fishermen never dreamed that the day would come when any protection would be required, but the Government has been obliged to enact a series of regulations ever more restrictive in character, without which the industry would have been in a much more serious condition than at present. These regulations, however, are not always effectively enforced, and as stated by Mr. W. A. Found, the Superintendent of Fisheries for Canada, in his excellent paper read before the Commission of Conservation in the year 1912, "It is very much to be feared that if more restrictive regulations are not enforced we can expect nothing but a continued decline in the lobster fisheries."

The time at my disposal permits me merely to mention two other industries which are more or less closely connected with the fishing trade. These are the hunting of the whale and of the walrus.

Concerning the whaling industry in Davis Straits, Baffin Land and Hudson Bay, Captain Bernier in his account of the first cruise of the "Arctic" in the year 1906-07 writes as follows:—

"In the height of the whaling industry there were from 600 to 800 whaling vessels in active service in the Atlantic, Pacific, and Arctic Oceans, hailing from the United States and from ports in the United Kingdon. There are now scarcely 50. There has not been, and cannot be, a revival of the industry, until there has first been a renewal of the supply of whales, and at the present time there appears to be no prospect of this. It must, therefore, be admitted that for the present at least the supply of whales is exhausted. Taking into consideration the state of things at present, a closed season should now be enforced, and remain so for ten or fifteen years. The whaling industry will soon be a thing of the past if no enactment is made for its temporary restriction."

The industry is now altogether in the hands of Americans, who having killed off all the whales in the waters of North Eastern Canada, have transferred their vessels to the Arctic waters which are reached from the Pacific Coast, and are there following the same process of extermination which has already led to the practical annihilation of the South Sea whale.

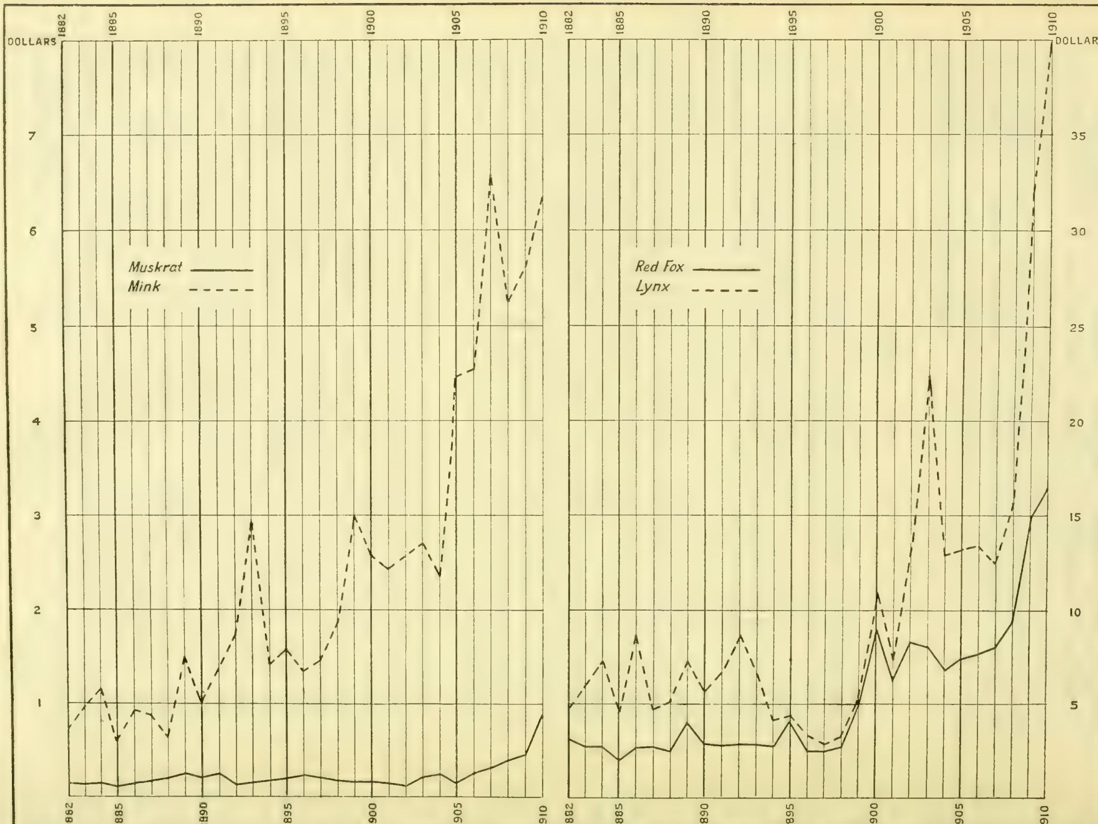
With regard to the walrus of our north eastern coasts, Commander Low in his report on the cruise of the "Neptune" writes:—"There has been a rapid diminution in the number of walruses in the northern part of Hudson Bay during the past few years, and it is only a question of a few years more, if the present method of killing is continued, before the walrus will be as rare as the right whale in the waters of Hudson Bay."

The Fur Trade.

The rise of the fur trade was almost coincident with the discovery of Canada, and with the establishment of the great fur trading companies their agents penetrated ever farther into the interior of the country until fur trading stations had been established in every accessible part of the area now embraced within the borders of the Dominion of Canada.

In recent years the ever advancing network of railway and steamboat communication has made it possible for hunters to carry their provisions and supplies into remote recesses of the continent which have hitherto been practically inaccessible. The last retreats of the fur-bearing animals have been invaded by their remorseless enemy, man. The musk ox, for instance, has only figured in the London sales during the last 40 years—before that time the hunters of the Arctic regions were unable to reach its habitat; the continued invasion of its territory makes its extinction more than probable in the not distant future.

As a result of these inroads, the fur-bearing animals are everywhere decreasing in number and notwithstanding the fact that hunting is everywhere being carried on with increasing vigour by the aid of modern guns, smokeless powder, improved traps and the most alluring baits and scents, the supply of furs obtained is constantly diminishing. Coincident with the falling off in the supply, there has been a remarkable increase in the demand for furs, especially for the most costly varieties. This has been most marked during the past 20 years owing to the increase of population and wealth among the people of northern countries where furs are required not only for comfort but also to satisfy the requirements of fashion. The value of the furs exported from Canada in the year 1913 was $5,415,118. This increased demand has, of course, been accompanied by a steady rise in price. This is illustrated by the following table showing the prices brought by certain staple skins at the great fur auctions in London in successive years.



STAPLE FURS, INCREASE IN PRICE

Year	Muskrat	Mink	Red Fox	Lynx
1882	$.16	$.73	$3.11	$4.87
1883	.15	.97	2.75	6.09
1884	.16	1.16	2.75	7.31
1885	.12	.59	2.07	4.51
1886	.16	.93	2.56	8.72
1887	.17	.89	2.60	4.70
1888	.19	.65	2.50	5.05
1889	.25	1.50	4.05	7.38
1890	.22	1.03	2.92	5.73
1891	.25	1.36	2.82	6.75
1892	.15	1.74	2.92	8.70
1893	.17	2.92	2.92	6.70
1894	.18	1.42	2.75	4.13
1895	.19	1.58	4.20	4.39
1896	.24	1.34	2.50	3.33
1897	.22	1.36	2.50	2.87
1898	.18	1.89	2.66	3.23
1899	.16	2.98	4.97	5.12
1900	.16	2.58	9.00	10.80
1901	.15	2.44	6.20	7.44
1902	.13	2.58	8.27	13.38
1903	.22	2.70	8.03	22.40
1904	.25	2.37	6.81	12.80
1905	.17	4.46	7.48	13.15
1906	.27	4.54	7.67	13.38
1907	.31	6.58	8.07	12.50
1908	.41	5.25	9.25	15.60
1909	.47	5.61	14.96	32.00
1910	.87	6.34	16.55	39.85

While the more costly furs are in ever-increasing demand notwithstanding their ever-increasing price—for the mere fact that they are enormously expensive creates an inextinguishable desire for them on the part of certain people—there has arisen an increasing demand for cheaper furs also. Scarcely any animal that has a furry coat is now safe to walk abroad, for some one seizes and slays it, although the

pelt continues its existence under a name and often under a guise in which its original possessor would never recognize it. Thus

Goats	become	transformed	into	Bears
Hares or Minks	"	"	"	Sables
Muskrats and Rabbits	"	"	"	Sables, Seals or Electric Seals
Opossums	"	"	"	Beavers
White Rabbits	"	"	"	Ermines
White Hares	"	"	"	Chinchillas
Raccoons	"	"	"	Silver Bears

Even the domestic cat, hitherto an unappreciated national asset, having exchanged its plebian designation for one which finds more acceptance in good society, "arrives," and in so doing often helps its wearer to do so also.

Notwithstanding all the art and artifices of the fur dresser, the supply of good fur continues to decrease and one fact stands out clearly, namely, that to meet the demand we must domesticate and breed our fur-bearing animals and no longer rely on hunting them. This change is to be welcomed for humanitarian reasons as well as for many others, since the most atrocious cruelty is perpetrated on our wild animals in almost every kind of trapping, the creatures often lying not only for hours but for days with crushed and broken limbs, maimed and smashed before the hunter arrives and finally relieves their suffering or some other animal finds them and tears them to pieces.

Furs can, of course, only be produced under certain climatic conditions and these are nowhere more favourable than in our Dominion. The breeding of fur-bearing animals is an industry of great promise which should, if carried on in a conservative and rational manner—as any other industry must be to meet with success—have a great future in Canada and be an additional source of wealth to the Dominion. It is not, I think, generally recognized that a number of the more important of these animals are already being bred in captivity—several of them in Canada—with success, although as yet only on a small scale. Among these are foxes of several varieties, mink, marten, fisher, muskrat, raccoon and skunk. The skins of the animals bred in captivity bring a higher price in the market than the skins of the same animals taken in the forest. Fox farming, especially in Prince Edward Island, indeed, although more or less discredited by the excessive speculation with which it has been associated, has proved to be a successful industry and one which is capable of great expansion. The Government returns show that there were on Prince Edward Island on January 1st, 1914, 277 fox "ranches," containing 3,178

Foxes in "Ranch."

Karakul Lambs three days and eight days old respectively. Both are in prime condition for killing. Born on Bunbury Farm, Prince Edward Island.

PLATE G.

foxes, of which 1,602 were silver foxes. In the returns in question these animals are estimated to have a value of $14,978,000 from which the Provincial Government derived an income of $37,000.

The skins from black and dark silver foxes on the Prince Edward Island ranches have rarely brought less than $500 apiece and frequently over $2,000 at the London auction sales.

Much could also be done to prevent the extermination of our fur-bearing animals by making all our National Parks and forest reserves "sanctuaries" for the animals who are their natural denizens. A sanctuary has been defined by Colonel Wood as a place where man is passive and the rest of nature active. This can be done by maintaining a really efficient system of patrol, with the prompt arrest and punishment of all who break the forest laws. Some of our parks are so protected and it is found that the animals rapidly increase in them and spread out into the surrounding forest. Many of our forest reserves, however, are absolutely without protection or patrol.

Sanctuaries might also be established in other parts of our northern country, for it must be borne in mind that much of it has no economic value except as a hunting ground, and it is, therefore, of the first importance to take steps, before it is too late, to prevent the disappearance of its fur-bearing animals. The general decrease in the number of these latter during the past 20 years shows how inefficient the establishment of close seasons from time to time has been to this end. As has been well said by Mr. J. Walter Jones, of the Dominion Commission of Conservation: "The whole problem of the protection of wild animals and the possibility of propagating them in captivity are broad questions that require more attention than has been given them in the past. A Dominion Furriers and Fur-Farming Association organized along similar lines to the Canadian Forestry Association and, like the latter, publishing its own journal, could do much to promote a healthy interest in protecting and propagating wild life. The organization of provincial associations would be the first logical step in such a movement. Representatives of the fur trade, the fur farms, the game wardens and commissioners, and the government experts could be called together for the purpose of establishing such a permanent national organization."

Conclusions.

In conclusion it may be said that Canada has been blessed with great natual resources. Each and all of these, however, already show signs of serious depletion.

Our mineral resources, like the mineral resources of every country, are in the very nature of the case being depleted in direct proportion to the growth of our annual output of the products of mine and quarry.

Our forests, which are by no means so extensive as is generally supposed, have been cut, slashed and burned in a reckless manner.

Our agricultural lands, although showing an ever-increasing output on account of the opening up of new tracts of virgin soil, are not yielding even approximately the returns of which they are capable were they farmed according to more improved modern methods.

Our water powers cannot be maintained at their maximum efficiency if the forest areas of their catchment-basins are not preserved.

The fisheries of British Columbia and of our inland waters are in serious danger.

With the continued advance of settlement our wild fur-bearing animals are in course of extermination.

Each and all of these resources of our national domain (with the exception of the mineral deposits) can, however, not only be restored to its original condition but may, if we take vigorous action at the present time, be conserved, cultivated and not only be made to yield a higher annual return than at present but while doing so to increase in value year by year, and be handed on by each generation to the succeeding one in a better and more productive condition than that in which it received them.

It is time for the people of Canada to awake to the realization of these facts, and in so doing to remember that in the last analysis the success of any policy of conservation depends upon the efficiency of the human unit.

The instinct of the savage which still survives in the ordinary man inclines him to seize what he can now and for himself and let others, including posterity, take their chance.

The national instinct for the preservation of the state does not, however, lend itself to any such practice of personal aggrandisement and selfish waste.

Canada should learn the lesson exemplified in the rise of such a powerful state as Germany—relatively poor in natural resources but becoming rich by their careful conservation and able husbanding.

This conservation is part of that "righteousness which exalteth a nation."

And finally, let us remember that—in the words of Dr. James Douglas—we should be preservers of the gifts with which a beneficent Providence has stored our world, for next to being a creator man reaches his highest position in being a saver—a saviour.

APPENDIX B

THE DOMINION ASTRONOMICAL OBSERVATORY

BY

W. F. KING, C.M.G., LL.D.

THE DOMINION ASTRONOMICAL OBSERVATORY AND THE BOUNDARY AND GEODETIC SURVEYS.

Astrophysics.

Visual observations of double stars have formed part of the work with the 15 inch equatorial refractor but as previously the principal work has been the spectroscopic determination of stellar radial velocities with special attention to spectroscopic binaries. During the year ending May 1st, 531 stellar spectograms have been secured and the orbit of one spectroscopic binary determined. Additional work on some previously secured orbits has been carried on which will shortly be published.

The decrease in the number of spectrograms secured has been due to poor observing weather, much the worst since the Observatory has been opened. This and the decrease in the number of stars available with this telescope will explain the falling off in the number of orbits obtained.

Experimental work undertaken with a view to increasing the efficiency of the spectrograph has conclusively shown that a considerable saving in exposure time and consequent increase in output and range results from the use of a prism of lighter glass than the dense flint usually employed and this with other improvements in the optical train easily effects a saving of forty per cent.

Work on the Solar Rotation with the Coelostat Telescope and Grating Spectrograph has been actively continued. Two series of Rotation Plates one in the special region at λ 5600 and the other in the general region at λ 4250 have been secured in pursuance of the International scheme adopted. A further series with a new reflecting prism device giving a much greater quantity of observing material and permitting, it is hoped, some new conclusions to be reached has also been obtained. The measures of the 1912 plates show a very close agreement with those of 1911, within one half of one per cent, and the conclusions reached previously have been confirmed.

The contracts for the 72 inch reflecting telescope were awarded last fall. For the optical parts to the J. A. Brashear Co., Pittsburgh, and for the mounting to the Warner and Swasey Co., Cleveland. The design of the mounting, upon which a great deal of time has been spent, is practically completed and construction work will shortly commence. The work of grinding and figuring the large mirror will begin as soon as the disc is received from the glass makers.

After observations extending over more than six months it has been decided to locate the new telescope near Victoria, B. C., where the climatic conditions especially as regards steadiness of seeing and low diurnal range of temperature are exceptionally good. Fifty acres of land on the summit of a hill of 732 ft. elevation conveniently situated about eight miles north of Victoria have been purchased and construction work on the necessary buildings will be commenced early next year.

Meridian Circle.

During the early months of 1913 the telescope was out of commission for repairs and alterations. In addition to several minor changes, the instrument was thoroughly balanced in every way, in preparation for the undertaking of fundamental observations. During the remainder of the year work was continued on the unfinished list of latitude stars which has been under observation for several years. Owing to continued bad weather, and to the fact that work was interrupted by the repairs to the telescope, the number of observations, exclusive of broken nights used only for clock correction, was somewhat under 1,000 in each co-ordinate.

Time Service.

The Time Service has been maintained as heretofore. Besides the dropping of the time-ball on Parliament Hill, recording the time on seismographs, sending out time-signals, &c., there are in operation somewhat over 300 electrically driven dials in the Government buildings in the city, which are operated by several secondary master-clocks continuously synchronized from the Observatory. For the synchronization of these a new method has been adopted, the chief merit of which lies in the fact that interruptions to the synchronizing line can under no circumstances cause the controlled clocks to stop. An automatic comparison is made every minute between the primary and the controlled clock, and during the next following minute the rate of the latter is either increased or decreased as required, by means of a small weight on the pendulum; the latitude allowed is about 1/100 second.

Field Observations.

During the summer of 1913 three observers were engaged in observations for latitude and longitude at various points. The

stations occupied included seven in British Columbia (one for latitude only), two in Alberta, and one in Ontario. The base station in longitude for the points in the west was Field B., C.; one station was also connected with Winnipeg, thus forming a triangle to strengthen the longitude of the base station. Observations for personal equation were made before the work began, and also later in the season. For all points except two, 3 inch Cooke transits with registering micrometers were used, the instruments being adapted for use as zenith telescopes by the addition of latitude levels. For the remaining two points a more portable form of broken-type telescope was employed.

Geophysics.

The two Bosch horizontal photographic pendulums and the Spindler and Hoyer, with mechanical registration, have been in operation during the past year. 95 distant earthquakes were recorded during the year, and a local one on Feb. 10 last which was felt over an area of about 200,000 square miles, an area eight times as great as the one in which the local quake of the preceding April was felt.

The undagraph was installed last September at Chebucto Head, outside of Halifax harbor, and exposed to the broad waters of the Atlantic. It gave good records by the periods of the waves impinging on the shore. Before the sea-end of the pipe was permanently secured it was swept away by a storm, and is now awaiting replacement. In connection with the International investigation of the deformation of the earth by the moon it was originally intended to make the observations at Winnipeg, but from various considerations Ottawa was chosen and two vaults some 23 feet beneath the surface have been built adjoining the Observatory, and one of them is to be devoted to the above purpose, while in the other new seismographs will be installed.

The magnetic survey of Canada has progressed satisfactorily and 53 stations were occupied during the year, distributed from Quebec to British Columbia. As heretofore the three magnetic elements,—declination, inclination, and intensity have been observed.

With the present season a systematic gravity survey of Canada by means of three-half seconds pendulums was begun. Observations with the apparatus were made at Washington before and after those at Ottawa, the base-station for Canada; so that thereby our observations will be linked up with those of the United States, and also with the international series.

International Boundary Surveys.

The survey and demarcation of the 141st meridian was completed in the year 1912 between the Arctic Ocean and Natazhat Ridge, south of White River, leaving about 90 miles to be surveyed between the Ridge and Mt. St. Elias. This is a region of high mountains, ice fields and glaciers. Mt. St. Elias is about 18,000 feet in height, Mt. Logan, farther north and to the east of the meridian 19,500 feet, and there are several other mountains of height not much less. The boundary line last year was produced across this region, measurements carried through by triangulation, a topographic survey of the vicinity of the line made with photographic camera and plane table and the final monuments at such points as were available, under the general conditions of perpetual snow or ice. This completes the field work of this survey.

At the southern end of the Alaska Boundary a triangulation was undertaken to determine the course of the boundary between Cape Muzon and the entrance to Portland Canal, and to connect the triangulation along the Alaska-British Columbia boundary with the Geodetic Survey of the British Columbia Coast. These operations were interrupted by a landslide at Cape Muzon, in which two unfortunate men, members of the boundary survey party, lost their lives. This section of the triangulation therefore had to be left over to the present year.

On the Ontario-Minnesota boundary, the survey of Lake of the Woods was completed, also of Rainy River and Rainy Lake in great part.

On the Quebec Maine boundary, the survey was completed (from the eastward) as far as the southwest branch of River St. John, which also was in part surveyed. It is intended this year to complete the survey of this river to its source and to enter upon the survey of the boundary along the Highlands.

The surveys in Passamaquoddy were completed and a number of marks placed to indicate the boundary.

Geodetic Survey.

Triangulation was carried on in British Columbia, Quebec, southern Ontario, and in northwestern Ontario, westward from Thunder Bay. The standard of accuracy has been maintained in this primary work.

A base line, 13·5 kilometers in length, was measured near Belleville, Ont., using three invar tapes, 50 metres long.

Precise levelling was carried on by four levelling parties, one in Nova Scotia, one in Ontario, and two between Lake Superior and Red River, Manitoba.

APPENDIX C

THE METEOROLOGICAL SERVICE OF CANADA

BY

R. F. STUPART, F.R.S.C.
Director, Dominion Meteorological Service.

THE METEOROLOGICAL SERVICE OF CANADA.

Reports have been received at the Central Office from 657 stations, including telegraph reporting stations, climatological and storm signal stations.

Forecasts and Storm Warnings:—Bi-daily synchronous weather charts have been compiled on every day throughout the year, Sundays and holidays included, based on telegraphic reports from 39 stations in Canada, 100 from the United States, 5 from Newfoundland, and 1 from Bermuda. These charts have formed the basis of the forecasts and storm warnings which have been issued from Toronto for all the provinces, exclusive of British Columbia. The daily chart showing the meteorological conditions over the Northern Hemisphere at 8 a.m. local time, which is usually ready for inspection by 11 a.m., affords much valuable information regarding the movements of cyclones and anticyclones in high latitudes, and will ultimately be the means of materially increasing the range of forecasts.

Storm warnings have been issued to 111 display stations in Canada and of 2,271 warnings issued 95% were verified by subsequent high winds; 304 warnings were received late, 186 owing to issue, and 118 owing to telegraphic delays.

Forecasts have been telegraphed twice daily to Newfoundland, and storm warnings were issued when it was deemed expedient. In all no less than 54 separate warnings were sent to display stations.

Magnetic Observations —Records of the various Magnetic elements were secured at the Agincourt Observatory, without interruption throughout the year. The zeros of the differential photographic recording instruments were determined by absolute observations as formerly, weekly for declination, and twice monthly for horizontal force. Absolute observations of inclination were made weekly with the Toepfer Earth Inductor.

Westerly Declination has increased from $6° \cdot 17' \cdot 1$ in March, 1913, to $6° \cdot 22' \cdot 4$ in March, 1914. The Horizontal Force has decreased from $0 \cdot 16150$ C.G.S. units to $0 \cdot 16099$, and the Inclination has increased from $74°40' \cdot 7$ to $74°41' \cdot 7$.

The year was marked by the absence of large Magnetic disturbance and the very infrequent occurrence of even smaller disturbances; 233 days were classified as calm; 126 as lightly disturbed, and 6 days as disturbed. The largest disturbance of the year occurred on May 5th and 6th. The range of Declination during the disturbance was $55' \cdot 0$ and in Horizontal Force the range was 121 gammas.

The mean diurnal range of Declination varied from a maximum of 12′·5 in August 1913, to a minimum of 4′·2 in February 1914, whilst that of Horizontal Force varied from a maximum of 38 gammas to a minimum of 10 gammas in corresponding months.

During the year index corrections for the Magnets attached to 88 surveyors' Theodolites were determined and supplied to the Surveyor-General.

Assistance and instruction was given to several surveyors in the use of the Total Force Instrument, and in the determination of their constants both before and after their field work.

Assistance was also given to Mr. French of the Ottawa Dominion Observatory in obtaining comparisons between his field instruments and the Agincourt standards.

Mr. W. H. McKinlay, who was assigned to the Stefansson Expedition as Magnetician, was given thorough instruction in the use of the Magnetic Instruments and was furnished with all necessary instruments and books for properly carrying on Magnetic Survey work.

A reduction of the Magnetic data obtained since 1872 at Toronto and Agincourt is also in progress, by Mr. W. E. Jackson, M.A.

Physics Branch.

The exploration of the upper atmosphere by means of balloons and kites has been continued satisfactorily, as fourteen records of pressure and temperature from heights ranging between 5 and 10 miles above the earth's surface have been obtained.

The following table gives a summary of the balloon records.

Date	A	B	C	D	E	F	G
1913							
May 6.........	8·1	—88	13	—74	N.E.	90·1	N.65E
May 9.........	7·5	—71	9·9	—69	S	193·2	S.80E
August 6.......	7·2	—59	8·1	—58	W	94·4	S.60E
Sept. 4........	9·1	—98	10·9	—80	S.W.	83·9	S.40E
Oct. 1........	9·4	—76	9·4	—76	N	62·1	S.75E
Nov. 5.........	7·7	—98	9·1	—91	S.E	176	S.22E
Nov. 7.........	7·2	—83	7·8	—80	N	211·3	N.65E
Dec. 4.........	6·4	—61	6·6	—59	S.E.	105	S.40E
1914							
January 8......	6·4	—59	7·7	—51	N	152	S.78E
February 2....	5·6	—57	9·6	—69	E	142·3	S.84E
February 3. ...	6·5	—76	7·8	—61	N.W.	182·1	N.70E
February 5	5·2	—63	6·5	—55	E	193·2	N.70E
February 6	6·2	—78	6·2	—78	W	220	N.86E

A. Height in miles to beginning of stratosphere.
B. Temperature Fahrenheit at beginning of stratosphere.
C. Greatest height, in miles, reached by balloon.
D. Temperature Fahrenheit at greatest height.
E. Direction balloon travelled at starting point.
F. Distance, in miles, of point where balloon fell from starting point.
G. Bearing of point where balloon fell from starting point.

A continuous record of the potential of the air has been obtained from the self-recording electronometer, and when possible daily observations of solar radiation have been obtained from the Angstrom Pyrheliometer.

Seismological Observations.

The Milne seismographs at Toronto and Victoria, B.C., have been kept in operation throughout the year and no change has been made in the adjustments of the instruments, the booms being kept at a period of 18 seconds. There has been a marked absence of any very large movements. The total number of disturbances recorded at Toronto was 105 and at Victoria 98, of which eighty-five per cent were less than one millimetre in amplitude. On February 10th, at 1h 32m·5, was recorded a pronounced local earthquake, the swing of the boom being 2·3 mm. This earthquake was felt throughout Ontario, Quebec, New England and New York States, and as far south as Washington, D.C. It was still more severely felt in the St. Lawrence Valley. In Toronto, pictures on the walls swayed and tall buildings perceptibly vibrated; no damage was done.

A small observatory building has been erected on Gonzales Hill, Victoria, B.C., which will afford better facilities for carrying on both the forecast work of British Columbia, and also the seismological research which under Mr. F. N. Denison's enthusiastic attention has become one of the most important subjects of scientific investigation in Victoria. Mr. Denison has been placed in charge of the new observatory and the forecasting, while Mr. E. Baynes Reed remains in charge of the climatological work which he has so ably conducted in the past.

A local Meteorological Office has been established in Vancouver where persons requiring information regarding the weather may apply. The daily time signals for the port will also be given from this office, and ship captains may there have their chronometers rated.

An observatory has also been erected in St. John, where the accommodation contained in the former building had become inadequate for both Meteorological and Time Service requirements.

The automatic apparatus at Camperdown, N.S., for repeating from land line to wireless has continued in operation. Navigators within the zone of that station are thus able to pick up this signal. Time balls at St. John and Halifax have been dropped each week-day at 1 p.m. Standard time of the 80th Meridian. The synchronizing signal for the Halifax clock which automatically drops the Time Ball has been sent every week-day morning at 10 a.m., excepting occasions of wire trouble when it was hourly repeated, until satisfactorily received.

Respectfully submitted.

R. F. Stupart,

Director.

Phenological Observations, Canada, 1913.

The collection of phenological statistics by the Meteorological Service is in charge of Mr. F. F. Payne, of the Central Office, Toronto, and the following report for 1913 has been prepared by him.

"Of the phenological observations in Canada for 1913, those in Nova Scotia as usual take first place, and although great efforts have been made to arouse similar interest in other provinces, they have so far failed. If the various departments of education could be induced to make the collection of phenological statistics part of the nature study in their schools, much valuable work from a climatological point of view might be done. If, too, the children in the various schools were made aware of the fact that their bringing the first blooms in spring to their teachers for identification and record was highly valued, it would add much to their interest in the work and make that part of nature study and teaching much easier. Great credit is due Dr. A. H. Mackay, Superintendent of Education for Nova Scotia for the lead he has taken in this direction, and the work performed by him and his assistants; also his valuable co-operation in supplying tables for that Province is much appreciated by the Meteorological Service."

"In the selection of the fifty phenological items contained in the Meteorological Service schedules, it was of first importance to have common or well-known plants, etc., also such as are to be found in most portions of Canada, in order that the dates from each district might be compared. Due consideration was also given to the importance of obtaining observations from swamp, wood and field. More items might be added, but the more formidable the list the fewer the observers, and the most valuable observations are those

by voluntary observers who have found the work easy enough to continue it at the same place for a number of years.

"Excellent schedules for 1913, as shewn by the tables, were received but the number was fourteen less than for 1912.

"The tables include first those observations received from British Columbia and eastward in order to New Brunswick; and secondly the average dates for each of the ten regions into which Nova Scotia is divided, together with the averages for the whole province deduced from several hundred approved schedules.

"Owing to the very large number of observers in Nova Scotia only those reporting for 1913 west of this province are given in the following list.'

List of Stations and Observers.

Stanley R. S. Bayne	Alberni, B.C.
Eli Wilson	Armstrong, B.C.
A. B. Taylor	Atlin, B.C.
W. H. Quant	Keremeos, B.C.
Mrs. H. Hunter	Princeton, B.C.
J. Strand	Quesnel, B.C.
C. F. Walker	Tzouhalem, B.C.
Lt. Col. F. J. Gavin	Walds, B.C.
N. B. Sanson	Banff, Alta.
C. Nixon	Bashaw, Alta.
Pupils of Earl Grey and Connaught Schools	Calgary, Alta.
Robert Jones	Fort Vermilion, Alta.
Mrs. W. L. Fulton	Halkirk, Alta.
Richard Paris	Lethbridge, Alta.
Duncan Cameron	Pekisko, Alta.
Thomas B. Waite,	Ranfurly, Alta.
Fred C. Sim	Clapton, Sask.
Miss R. A. Clarke	Fleming, Sask.
R. H. Carter	Fort Qu'Appelle, Sask.
Geo. Lang	Indian Head, Sask.
Pupils of Lashburn School	Lashburn, Sask.
Arthur McIntosh	Macdowall, Sask.
C. W. Bryden	Mistawasis, Sask.
P. H. Gallaway	Wolseley, Sask.
William Irvine	Almasippi, Man.
E. F. Heath	Cartwright, Man.
C. J. Baragar	Elm Creek, Man.
Miss Mary R. Dutton	Gilbert Plains, Man.
W. E. Iverach	Isabella, Man.
A. Goodridge	Oak Bank. Man.
Miss E. Smith	Oak Bluff, Man.
Dr. H. M. Speechly	Pilot Mound, Man.
Jas. D. Plaice	Rapid City, Man.

Norman Criddle	St. Albans (Aweme) Man.
A. G. Lawrence, H. C. Cox and W. Martin	Winnipeg, Man.
John Hollingworth	Beatrice, Ont.
Miss M. Moffitt	Cape Crôker, Ont.
Thos. Smith	Cottam, Ont.
W. E. McDonald	Lucknow, Ont.
Chas. J. Young	Madoc, Ont.
L. G. Morgan	Port Cover, Ont.
Miss A. M. Thompson	Queensboro, Ont.
F. F. Payne	Toronto, Ont.
David McKenzie	Abitibi, Que.
Fr. M. Alberic	Mistassini, Que.
J. H. Burnett	Fredericton Junction, N.B.
R. A. Long	Centreville, N.B.

I. Phenological Observations, Canada, 1913.

Year 1913

Day of the year corresponding to the last day of the month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen												Year 1913		When becoming common											
Alberni, B.C.	Armstrong, B.C.	Atlin, B.C.	Keremeos, B.C.	Princeton, B.C.	Quesnel, B.C.	Tzouhalem, B.C.	Waldo, B.C.	Banff, Alta.	Bashaw, Alta.	Calgary, Alta.	Fort Vermilion, Alta.			Alberni, B.C.	Armstrong, B.C.	Atlin, B.C.	Keremeos, B.C.	Princeton, B.C.	Quesnel, B.C.	Tzouhalem, B.C.	Waldo, B.C.	Banff, Alta.	Bashaw, Alta.	Calgary, Alta.	Fort Vermilion, Alta.
101	94	133				82					155	1. Alder (Alnus incana)	Shedding pollen	101	102										
186			161				191					2. Canada Thistle (Cirsium arvensis)	Flowering				168				194				
						120	126				157	3. Trailing Arbutus Epigæa repens)	"								130				
85	113	160	119	123	137	79	125	150	146	117	158	4. Dandelion (Taraxacum officinale)	"		151		126				131	166	151	136	
110		173		115	126	109	123	156	130	109	137	5. Violet, Blue (Viola cuculatta)	"			180		120			125	161	132	121	
	113			134	130	70	140			132	140	6. Violet, White (Viola blanda)	"		140						148				
149		166		157	135			168		152		7. Columbine (Aquilegia)	"					165				178			
	140		102	121			104	164	138	139	135	8. Trees appear green	"			154	108				121			143	
155	156		152	164	103		146			164		9. Red Clover (Trifolium pratense	Flowering		166		189	169			153				
145	158		155		109		138	150		165		10. White Clover (Trifolium repens	"	155	168		168	158			144	166			
155	168		152	160	149			176		171	171	11. Wild Raspberry (Rubus)	"				158								
119	140		118	129		109	130		152	139	146	12. Cultivated Currant (Ribes rubrum)	"				123	140			132		155		
156	156	170	142	153	156		144	166		152	166	13. Wild Rose (Rosa lucida)	"		168		150	157			153	176			
105						96	148					14. Trillium (Trillium)	"												
	153	120					100	109		89		15. Anemone (Anemone patens)	"			130					102	130		109	
125	125		149			110		155			143	16. Maple (Acer)	"				113								
124	140	156	117	121	160	106	141	144	132	109	144	17. Strawberry Wild (Fragaria Virginiana)	"		156		126	130			118		135	130	
166	168		120	159			162	181	182	145	172	18. Strawberry Wild (Fragaria Virginiana)													

													Fruit Ripe	177	176		135			166		191		
54						53			98			19. Crocus, Cultivated (Iris)	Flowering									101		
146			145	150	148	137	181			156	171	20. Lilac (Syringa vulgaris)	"				150	154						
137	140		121	143		121	140				159	21. Apple (Pyrus malus)	"		144		130	148		144				
125	130		116			106	140					22. Plum, Cultivated (Prunus domestica)	"		135		121			144				
135	140		115				125	174	153	146	151	23. Cherry, Wild (Prunus)	"				120			128	176			
135	135		121			109	130				160	24. Cherry, Cultivated (Prunus Cerasus)	"				130			138				
144	97		69	90	117		168	190			142	25. Buttercup (Ranunculus acris)	"		115		79	101						
						137						26. Yellow Pond Lily (Nuphar advena)	"											
165	155					85	179	172		145	148	27. Blue-eyed Grass (Sisyrinchium)	"											
132	138		109	132			128	156	145	125	150	28. Saskatoon (Amalanchier Canadensis)	"		144		116			125	160	149		
	215						193	191	196	199		29. Golden Rod (Solidago)	"		224					197				
112		121	102		96	112	63	67	93	101	102	30. Wild Geese	"				114					95		
		117	69		93		93		91	95	103	31. Wild Ducks	"				91			108	118	94	102	
56	65	121	84	53	80		92	62	98	64	109	32. Robins (Merula migratoria)	"		74		91	69		95	102	105	114	
123	67		84	63			98	97		100	144	33. Meadow Lark (Sturnella magna)	"		79		91	88					108	
88	88	111	84	89	102		91	92		96		34. Blue Birds (Sialia sialis)	"				91	91		95				
		152			119						125	35. Flicker or Golden Woodpecker (Colaptes auratus)								118	110			
	90			105			123			119		36. Song Sparrow (Melospiza fasciata)	"					110		128				
92		131	110	151	107	90	96	118		100	152	37. Swallows (Clivicola riparia)				138	132	173		98				
								101	91			38. Juncoes (Junco hyemalis)									105	94		
135							133					39. Orioles (Icterus galbula)								150				
			157							99		40. King Birds (Tyrannus tyrannus)					166							
		132	141	137	157	97	131	154				41. Humming Birds (Trochilus colubris)					150	142		150				
66	94	131	111	106		66	111	108	101	105	121	42. Frogs Piping			100	133	121				130	103		
			74	102	91		104	152	121		121	43. Earth Worm Casts (Frost out of Ground)					79							
		149					113	149	121		132	44. Lakes Open												
		124		77	92		93	108		95	104	45. Rivers Open												
70	100		91	104	105		99		97	97	109	46. Ploughing			106		97			101		104	121	
91	102	144	127	104	105		92		110	104	115	47. Sowing					114						124	118
189	171		152	188	205		211		206	189	198	48. Hay Cutting		196	191		158							202
	201		213		252				239	232	214	49. Grain Cutting		244	217		222					248		224
121	105	134	102	109	134		118		128	132	125	50. Potato Planting					114	130		125		132		

II. Phenological Observations, Canada, 1913.

Day of the year corresponding to the last day of the month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen

		Halkirk, Alta.	Lethbridge, Alta.	Pekisko, Alta.	Ranfurly, Alta.	Clapton, Sask.	Fleming, Sask.	Fort Qu' Appelle, Sask.	Indian Head, Sask.	Lashburn, Sask.	Macdowall, Sask.	Mistawasis, Sask.	Wolseley, Sask.
1. Alder (Alnus incana	Shedding pollen								147		116		
2. Canada Thistle (Cirsium arvensis)	Flowering		161		181	159	178	213	205	166	202		
3. Trailing Arbutus (Epigæa repens)	"												
4. Dandelion (Taraxacum officinale)	"	153	137		141	161	119		139	143	103	147	94
5. Violet, Blue (Viola cucullata)	"	138		142	131	132	128	129	127	127	129	126	125
6. Violet, White (Viola blanda)	"			142	138	145	133	137	149	131	114		124
7. Columbine (Aquilegia)	"		158		159	163			194				
8. Trees appear green	.....		110	143	125	130	118	145	111	127	130		121
9. Red Clover (Trifolium pratense	Flowering		157				158	168	175	154			148
10. White Clover (Trifolium repens)	"		146		160		152		170	141	153		152
11. Wild Raspberry (Rubus)	"				161	152	141	171	152	158	173		152
12. Cultivated Currant (Ribes rubrum)	"		134		130	140	150	152	153		147		111
13. Wild Rose (Rosa lucida)	"	167	161		168	161	161	148	166	159	159	161	162
14. Trillium (Trillium)	"												
15. Anemone (Anemone patens)	"	132		166	103	105	104		101		106	106	97
16. Maple (Acer)	"		106		113	135			128		150		102
17. Strawberry Wild (Fragaria Virginiana)	"	130		143	135	147	135	142	144	132	129	140	130
18. Strawberry Wild (Fragaria Virginiana)		175			171	171	167	170	163	165	166	168	166

When becoming common

	Halkirk, Alta.	Lethbridge, Alta.	Pekisko, Alta.	Ranfurly, Alta.	Clapton, Sask.	Fleming, Sask.	Fort Qu' Appelle,	Indian Head, Sask.	Lashburn, Sask.	Macdowall, Sask.	Mistawasis, Sask.	Wolseley, Sask.
1.												
2.		175		191	163	184		209		215		
3.												
4.	168	140		145	166	138		145	160	158		135
5.	147			133	153	135	135	132	134	135		130
6.				149	148		144	155	141	147		135
7.		166		163	166			197				
8.		149		133	132	132	135	141	145	140		130
9.		165					171	191				155
10.		152		169		163		176		157		156
11.				167	152	152		166	165	174		155
12.		142		140	145	152		159		149		132
13.	182	165		166	163			175		163		166
14.												
15.	107			110	105	110		105		109		106
16.		121		120				132		128		110
17.	139		150	138	150	144	150	146	141	141		135
18.												

												Fruit ripe	193			175	178	175		171		183	
	102	108					141				135	19. Crocus, Cultivated (Iris) Flowering		106		164				145			135
	138		153		155		152	147	164		135	20. Lilac (Syringa vulgaris) "		148		159		158		159	153		145
	122		143				147	147			145	21. Apple (Pyrus malus) "		139		147				155	153		152
			143		151		148	147				22. Plum, Cultivated (Prunus domestica) "				150				156	153		
			147	145	151	141	149	145	145		140	23. Cherry, Wild (Prunus) "				150	150	155	147	155	153	148	145
			141								150	24. Cherry, Cultivated (Prunus Cerasus) "				146							155
115		116	168	121	104		143	102	105	108	103	25. Buttercup (Ranunculus acris) "	128			115	125	118		147	132	110	110
			164	166	167		150					26. Yellow Pond Lilly (Nuphar advena) "				171	171			163			
154			149	153	152	148	191		159	162	143	27. Blue-eyed Grass (Sisyrinchium) "	160			152	156	156		196		161	152
			142	145	140	143	142	140	143	147	135	28. Saskatoon (Amalanchier Canadensis) "				148	150	147	148	147		147	142
196			190	201	193	152	204	213	216			29. Golden Rod (Solidago) "	208			193	206	199			135	232	
96	100	134	94	115	91	91	95		108	96	94	30. Wild Geese		114		110	120	130		96			98
100	93	103	98	115	83	96	92	91	95	96	94	31. Wild Ducks	128	108		105	120	110	102	95	127	104	100
	99	103	106	121	90	97	97	88	102	103	91	32. Robins (Merula migratoria)		110	140	112	125	110	99	100	132	108	105
100	91	103	145	110	83	96	94	106	102	100	90	33. Meadow Larks (Sturnella magna)		98			115	109	105	95	132	111	98
		106	154	125							121	34. Blue Birds (Sialia sialis)					100						128
			110	125	100	110	108		107		86	35. Flicker or Golden Woodpecker (Colaptes auratus)				114	130	121	120	112		118	115
	104	106	103	152		109	93		121		91	36. Song Sparrow (Melospiza fasciata)		107						96		138	93
161		142	123	145	89	151	117		109	149	94	37. Swallows (Clivicola riparia)				130	150	121				130	121
			127			95	95		100			38. Juncoes (Junco hyemalis)				134				96		115	
				147	130	144	142				101	39. Orioles (Icterus galbula)					147	149	152	144			130
			130	125	112	156	142		155		94	40. King Birds (Tyrannus tyrannus)				136	130	121	166	144		155	110
			158				154				151	41. Humming Birds (Trochilus colubris)											152
104	130	108	101	105	90	102	102	91	101	102	98	42. Frogs Piping		136		105	110	100		102		104	100
97				105	107		111				98	43. Earth Worm Casts (Frost out of Ground)				100	115						110
114		110	118	110	116	121	121		101	105	115	44. Lakes Open			116	120	115					109	121
				110	110		135		105	107	97	45. Rivers Open											103
114	65	112	100	105	101	101	134	104	108		93	46. Ploughing	94	100		105	110	105				115	102
101	93	114	108	115	105	103	135	105	109		93	47. Sowing	110	100		114	115	110				126	111
204	167	196	209	209	211	167	190		185		151	48. Hay Cutting	212	173		220	211	214				206	184
234	204	227	213	226	232	226	212	238	220	244	222	49. Grain Cutting	240	224		237	237	237	232		243	238	115
142	105	130	122	130	121	138	141	127	140	141	109	50. Potato Planting	142	140		142	137	121				144	130

III. Phenological Observations, Canada, 1913.

Year 1913

Day of the year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen

	Almasippi, Man.	Cartwright, Man.	Elm Creek, Man.	Gilbert Plains, Man.	Isabella, Man.	Oak Bank, Man.	Oak Bluff, Man.	Pilot Mound, Man.	Rapid City, Man.	St. Albans (Aweme), Man.	Winnipeg, Man.	Beatrice, Ont.
1. Alder (Alnus incana)......Shedding pollen										105		
2. Canada Thistle (Cirsium arvensis)..Flowering	199	209							206	186		
3. Trailing Arbutus (Epigæa repens) .. "					186							
4. Dandelion (Taraxacum officinale)... "	139	128	139	116	145		133	135	138	145	139	118
5. Violet, Blue (Viola cucullata)...............	144	127	139		129	127	133	127	127			115
6. Violet, White (Viola blanda)....... "	144	135			151			143	133			115
7. Columbine (Aquilegia)............ "					150			15	1	149		
8. Trees appear green.........................	110	140	149	146	132	140		127	135		112	125
9. Red Clover (Trifolium pratense) ...Flowering					160	179						
10. White Clover (Trifolium repens).... "				149	184	165	140	171		160		
11. Wild Raspberry (Rubus) "	165	169			187				157	154		
12. Cultivated Currant (Ribes rubrum) "		143	147		159		146	147	145	137		
13. Wild Rose (Rosa lucida).......... "	162	169		161	159	166			163	161	164	
14. Trillium (Trillium) "							146			147		129
15. Anemone (Anemone patens........ "	119	118	110	105	160			100	105	103	105	
16. Maple (Acer) "			140	109	120	110	110	123		111		
17. Strawberry Wild (Fragaria Virginiana) "	146	148			136	146	138	143	133	132	152	125
18. Strawberry Wild (Fragaria Virginiana)	176				168		171		165	160		

When becoming common

	Almasippi, Man.	Cartwright, Man.	Elm Creek, Man.	Gilbert Plains, Man.	Isabella, Man.	Oak Bank, Man.	Oak Bluff, Man.	Pilot Mound, Man.	Rapid City, Man.	St. Albans (Aweme), Man.	Winnipeg, Man.	Beatrice, Ont.
1. Alder (Alnus incana)......Shedding pollen										109		
2. Canada Thistle (Cirsium arvensis)..Flowering	201								211	195		
3. Trailing Arbutus (Epigæa repens) .. "					201							
4. Dandelion (Taraxacum officinale)... "		140	145	125	147	151	151	140	143	149	144	
5. Violet, Blue (Viola cucullata)...............	146		145		136		151	132	130		122	
6. Violet, White (Viola blanda)....... "	146				155				137			
7. Columbine (Aquilegia)............ "					159					155		
8. Trees appear green.........................	110		148		148		119	153		146		
9. Red Clover (Trifolium pratense) ...Flowering												
10. White Clover (Trifolium repens).... "				157	206	178				165		
11. Wild Raspberry (Rubus) "	165				191				161	161		
12. Cultivated Currant (Ribes rubrum) "			151		194				148	144		
13. Wild Rose (Rosa lucida).......... "						178			169	166	166	
14. Trillium (Trillium) "										152		
15. Anemone (Anemone patens........ "	122		115	112			105	105	108	104	110	
16. Maple (Acer) "			145	114	120		119			114		
17. Strawberry Wild (Fragaria Virginiana) "					150		140		142	139	142	
18. Strawberry Wild (Fragaria Virginiana)												

												Fruit ripe					172		181				
				173						104		19. Crocus, Cultivated (Iris) Flowering					173		166				
			149	157	157	151	151	152	150	149		20. Lilac (Syringa vulgaris)........... "				156	159		155		155	154	152
						147	161	145	149		127	21. Apple (Pyrus malus).............. "							150	166	150	152	
	146	146			139		146				126	22. Plum, Cultivated (Prunus domestica) "			150			145		149			
143	146	146	146	184	146		140	145	137	147	127	23. Cherry, Wild (Prunus) "	146		150	121	192		146	145	148	143	150
	151											24. Cherry, Cultivated (Prunus Cerasus) "											
113		135	105	112			107	106		107		25. Buttercup (Ranunculus acris)...... "	145		144	114	113			120	113		
	163											26. Yellow Pond Lilly (Nuphar advena) "											
					161		159	154	142			27. Blue-eyed Grass (Sisyrinchium).... "						173		161	158	150	
	146			154	139		140	144	131			28. Saskatoon (Amalanchier Canadensis) "					156		146		147	139	142
	213			209				213	197			29. Golden Rod (Solidago) "					211		191		218	213	
95	94	100	96	104	132		93	94	94	95		30. Wild Geese..............................	110		105		104		94	100	77	104	100
95	90	97	97	94	102		91	94	94	95		31. Wild Ducks..............................	110		105		100		100	100	98	104	
96	109	105	96	97			95	95	94	96	112	32. Robins (Merula migratoria)................			115		103			100	98	99	103
95	94	100	92	85	100		95	96	94	99	79	33. Meadow Larks (Sturnella magna............	100		105		105		94	100	99	101	104
137				153				121				34. Blue Birds (Sialia sialis)....................					160				121		
101	111		109	103			106		104	111		35. Flicker or Golden Woodpecker (Colaptes auratus)	105				111			115		111	
95	97						120		98	107	101	36. Song Sparrow (Melospiza fasciata)...........	100							122		108	109
147		139					127	137	121	102		37. Swallows (Clivicola riparia).................			146				144	135	143	150	
137	96			89			95		94	100		38. Juncoes (Junco hyemalis)..................					89			96		98	105
146	151		145	159	156		144	145	143	147		39. Orioles (Icterus galbula)....................					159		152	152		151	
146	161			161			144	146	141	147		40. King Birds (Tyrannus tyrannys)					167			146	146	147	147
153	151	144							147			41. Humming Birds (Trochilus colubris).........											
100	147	100	100	102	101		102	101		103	99	42. Frogs Piping...............................	102		110		104		102	115	103		104
119	125	100					105				124	43. Earth Worm Casts (Frost out of Ground)...	122							110			
			95				105					44. Lakes Open................................											
93	93	95	91				98	104	90	100	98	45. Rivers Open...............................											
104	104	104	107	107	105		110	101	93	95	112	46. Ploughing................................	106		110		110		102	115			102
110	104	108	107	104	121		108	107	101	104	117	47. Sowing....................................	110		116		115		111	115			109
198	201	196		207	196		196	205			200	48. Hay Cutting...............................		208	201		207		199	199			
219	223	224	234	210	239		219	226	220		224	49. Grain Cutting.............................	223		230	238			232	227	232		
135		144	120	152	130		134	138		132	133	50. Potato Planting..........................	139				152		146	140			

IV. Phenological Observations, Canada, 1913.

Year 1913

Day of the year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen

		Cape Croker, Ont.	Cottam, Ont.	Lucknow, Ont.	Madoc, Ont.	Port Dover, Ont.	Queensboro, Ont.	Toronto, Ont.	Abitibi, Que.	Mistassini, Que.	Fredericton Junction, N.B.	Centreville, N.B.
1. Alder (Alnus incana)	Shedding pollen		118				99	103			87	138
2. Canada Thistle (Cirsium arvensis)	Flowering			191		208	182	191				187
3. Trailing Arbutus (Epigæa repens)	"							102			104	
4. Dandelion (Taraxacum officinale)	"	121	120	110	119	114	124	122		139	125	133
5. Violet, Blue (Viola cucullata)	"		115		125	105	120	121			119	122
6. Violet, White (Viola blanda)	"		121		123	109	117	116			116	123
7. Columbine (Aquilegia)				157	135	153	126	144				166
8. Trees appear green		107	116	123	122	141	117	121	149	146	126	118
9. Red Clover (Trifolium pratense	Flowering		172	165	175	137		158			164	174
10. White Clover (Trifolium repens)	"		161	159	160	143					155	159
11. Wild Raspberry (Rubus)	"			160	136	143		150			135	140
12. Cultivated Currant (Ribes rubrum)	"		130	127	128	148	123					138
13. Wild Rose (Rosa lucida)	"				157	155						171
14. Trillium (Trillium)	"			118	123	102	124	116			133	125
15. Anemone (Anemone patens)	"				160	95	151					139
16. Maple (Acer)	"		91		111	135	126	82			117	118
17. Strawberry Wild (Fragaria Virginiana)	"		130	121	125	118	124	121			119	134
18. Strawberry Wild (Fragaria Virginiana)				158	158	157	160					165

When becoming common

		Cape Croker, Ont.	Cottam, Ont.	Lucknow, Ont.	Madoc, Ont.	Port Dover, Ont.	Queensboro, Ont.	Toronto, Ont.	Abitibi, Que.	Mistassini, Que.	Fredericton Junction, N.B.	Centreville, N.B.
1. Alder (Alnus incana)	Shedding pollen						103	108			98	143
2. Canada Thistle (Cirsium arvensis)	Flowering			198			193					199
3. Trailing Arbutus (Epigæa repens)	"										111	
4. Dandelion (Taraxacum officinale)	"	126	135	123	121	116	124	125			134	122
5. Violet, Blue (Viola cucullata)	"	128		124	127		120	121			122	121
6. Violet, White (Viola blanda)	"		135	124	124		120	116			120	131
7. Columbine (Aquilegia)				160	146		131					174
8. Trees appear green		122	130		124		124					125
9. Red Clover (Trifolium pratense	Flowering			168			171				166	182
10. White Clover (Trifolium repens)	"			164			165				158	167
11. Wild Raspberry (Rubus)	"						167				138	146
12. Cultivated Currant (Ribes rubrum)	"			140			127					145
13. Wild Rose (Rosa lucida)	"											181
14. Trillium (Trillium)	"	121		122	125		128	121			140	132
15. Anemone (Anemone patens)	"						161					143
16. Maple (Acer)	"				116			95			120	140
17. Strawberry Wild (Fragaria Virginiana)	"	128		124			140	125			127	143
18. Strawberry Wild (Fragaria Virginiana)												

											Fruit ripe			172		166	171		201		175
			128	74	110					215	19. Crocus, Cultivated (Iris) Flowering			73		79	120				222
	132	141	127	143	139	136			151	160	20. Lilac (Syringa vulgaris)........... "				147	148	146	140		154	165
	140	135	125	127	126	121			133	142	21. Apple (Pyrus malus)............... "			142	128		136	124		140	148
	118	124	123	123		122			126	131	22. Plum, Cultivated (Prunus domestica) "	128		125	126			125		128	140
	130	124	124	113	124	121			131	128	23. Cherry, Wild (Prunus) "		140	127	125		138	124		132	137
	123	122	128	121	126	121				132	24. Cherry, Cultivated (Prunus Cerasus) "			124				125			140
			124	141	154	149			155	151	25. Buttercup (Ranunculus acris)...... "				125		163			157	157
			155	188	157				148	154	26. Yellow Pond Lilly (Nuphar advena) "						172			150	165
			154		157	150			156	157	27. Blue-eyed Grass (Sisyrinchium).... "						157			157	165
					124				125		28. Saskatoon (Amalanchier Canadensis) "						124			125	
		214		202	214					219	29. Golden Rod (Solidago) "			223		206	230				231
	108						106			85	30. Wild Geese..........................						100				101
80			75		89		106			95	31. Wild Ducks..........................						94				101
76	66	72	77	70	71	72	108		87	84	32. Robins (Merula migratoria)................	92			80		74	96		90	101
78	92	72	77	71	78	73				84	33. Meadow Larks (Sturnella magna)...........	96					89	87			101
	69	72	73	70	73	73			87		34. Blue Birds (Sialia sialis)...................				80		73	96		90	
	93		108	79	107	96	113		112	79	35. Flicker or Golden Woodpecker (Colaptes										
											auratus)........................				110		110	105		114	98
			73	99	74	78			87	100	36. Song Sparrow (Melospiza fasciata)...........	100			75		74	96		90	108
	137		119	125	105	116	122		115	124	37. Swallows (Clivicola riparia)................	122			121		121	125		120	135
	128		63		78				87	89	38. Juncoes (Junco hyemalis)..................				88		91	102		92	104
		125	124	150	124	133					39. Orioles (Icterus galbula)..................				127		127	140			
138		123	127	145	134				128	102	40. King Birds (Tyrannus tyrannus)............				134		134			135	118
136		130	147	156	138					154	41. Humming Birds (Trochilus colubris).........						140				163
103	78	78	101	78	91	132	131	115	94	113	42. Frogs Piping..........................			83			101	103		98	119
	69			80	113	85	140	118	110	100	43. Earth Worm Casts Frost out of Ground) "	121					115	97			119
107			104	75			128	121		94	44. Lakes Open..........................										99
			73	79	89		119	117		89	45. Rivers Open..........................						92				93
92		91	106	104	104	73		115		106	46. Ploughing............................	105		104			111	100	125		119
102	104	105	108	107	108	100		126		118	47. Sowing..............................	110		113	111		127	115			126
183	179	181	177	168	186	109		205		193	48. Hay Cutting..........................						196		217		197
	182	200	195	195	200			253		232	49. Grain Cutting..........................		193				222				
130	118	121	115	107	111			150		126	50. Potato Planting........................			140	121		139				137

V. Phenological Observations, Canada, 1913.

Year 1913

Day of the year corresponding to the last day of each month.

Jaunary	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen

Species	I. Yarmouth and Digby.	II. Shelburne, Queens and Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VII. Cumberland, Pictou. Antigonish, Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.	Average Dates.
1. Alnus incana, Wild	94	93	101	96	117	100	98	111	110	110	103
2. Populus tremuloides		107	98	115	125	112	109	114	123	123	114
3. Epigæa repens, L	85	92	98	104	103	104	107	112	110	110	102
4. Equisetum arvense	115	113	117	121	123	121	119	126	123	123	120
5. Sanguinaria Canadensis		130	140	125		119	118	132	158	158	135
6. Viola Blanda	112	114	117	119	115	117	117	119	119	119	116
7. Viola palmata, *cucullata*	114	118	119	122	123	120	120	126	124	124	121
8. Hepatica triloba, etc		116	150	123	125		116	134	128	128	127
9. Qcer rubrum	117	121	116	121	124	121	118	129	121	121	120
10. Fragaria Virginiana	116	117	121	119	120	119	120	125	121	121	119
11. " " fruit ripe	158	158	159	163	163	168	165	172	166	166	163
12. Taraxacum officinale	114	117	121	125	125	125	124	130	127	127	123
13. Erythronium Americanum	118	149	155	124	157	124	123	150			137
14. Coptis trifolia	118	119	125	128	125	127	128	131	130	130	126

When becoming common

Species	Average Dates.	I. Yarmouth and Digby.	II. Shelburne, Queens, Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VII. Cumberland, Pictou. Antigonish, Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.
1. Alnus incana, Wild	111	104	101	113	104	120	109	102	118	120	120
2. Populus tremuloides	123		117	107	121	132		114	121	136	136
3. Epigæa repens, L	111	102	102	109	112	111	115	115	118	116	116
4. Equisetum arvense	126	121	119	126	128	129	128	125	132	128	128
5. Sanguinaria Canadensis	138		130	145	130		122	124	135	158	158
6. Viola Blanda	123	123	120	123	124	123	123	124	124	126	126
7. Viola palmata, *cucullata*	128	123	123	126	127	130	129	127	132	131	131
8. Hepatica triloba, etc	131		116	153	131	133		122	138	128	128
9. Qcer rubrum	126	122	126	121	128	129	130	124	132	126	126
10. Fragaria Virginiana	128	125	125	129	127	128	131	128	132	130	130
11. " " fruit ripe	172	173	170	171	173	175	172	171	175	171	171
12. Taraxacum officinale	130	128	123	127	131	131	133	130	135	134	134
13. Erythronium Americanum	143	135	154	158	131	159	133	128	152		
14. Coptis trifolia	133	130	126	131	134	132	133	136	138	134	134

	125	136	124	129	115	121	143	120	120	126	15. Claytonia Caroliniana	132		125	142	131	135	119	126	149	129	129
128	123	160	123	132	139	129	146	126	126	133	16. Nepeta Glechoma	141	156	129	163	130	134	145	136	150	131	131
127	128	126	131	138	130	123	144	135	135	131	17. Amelanchier Canadensis	138	132	133	134	136	142	137	134	148	143	143
	204		125	166		143				159	18. " " fruit ripe	168		230		130	166		148			
126	137	134	139	140	135	134	152	148	148	139	19. Prunus Pennsylvanica	145	136	142	139	145	145	143	140	158	151	151
							222			222	20 " " fruit ripe	240								240		
123	125	128	136	136	135	134	152	153	153	137	21. Vaccinium Can. and Penn	145	134	133	136	144	143	144	143	160	159	159
	174	139	145			165	227			170	22. " " fruit ripe	180		174	167	148			166	247		
139	140	146	150	152	143	148	156	153	153	148	23. Ranunculus acris	156	151	147	154	158	156	153	157	163	164	164
139	145	145	155	159	152	156	164	158	158	153	24. R. Repens	159	148	152	155	161	161	157	164	168	163	163
150	143	137	143	149	138	143	154	158	158	147	25. Trill, erythrocarpum	153	161	147	143	150	158	147	149	156	163	163
131	132	138	144	148	142	146	157	151	151	144	26. Rhododendron Rhodora	149	139	139	145	147	154	149	151	160	154	154
139	145	136	150	151	149	149	151	146	146	146	27. Cornus Canadensis	154	152	152	143	156	156	155	155	165	153	153
	208	170	149	157			183			173	28. " " fruit ripe	184		225	175	156	161			207		
141	147	146	146	151	147	145	155	147	147	147	29. Trientalis Americana	152	144	154	155	154	157	154	151	156	149	149
152	150	149	156	157	156	150	156			153	30. Clintonia borealis	159	157	156	153	163	166	161	157	160		
	155	168	154	157		160	168			160	31. Calla palustris	165		164	170	162	158		168	171		
156	152	148	160	162	151	157	170	164	164	158	32. Cypripedium acaule	164	162	159	155	165	165	159	160	174	170	170
156	153	153	158	161	156	159	168	162	162	158	33. Sisyrinchium angustifol	165	162	159	159	162	166	162	164	171	172	172
159	159	163	167	168	160	160	166	151	151	160	34. Linnæa borealis	164	162	165	164	172	172	162	163	167	157	157
154	148	144	150	154	147	144	160	161	161	152	35. Kalmia glauca	159	160	154	148	155	157	157	154	163	171	171
141	160	157	159	160	152	157	161	169	169	158	36. Kalmia augustifolia	163	150	167	158	162	165	158	163	166	171	171
157	158	154	158	163	157	158	175	160	160	160	37. Cratægus oxyacantha	166	163	165	159	163	166	165	165	176	168	168
157	156	160	158	162	162	155	156	167	167	160	38. Cratægus coccinea, etc	164	164	162	161	166	170	164	162	162	167	167
161	158	160	165	165	157	166	174	169	169	164	39. Iris versicolor	168	165	165	163	170	171	162	170	176	170	170
157	159	166	164	167	169	166	173	175	175	167	40. Chrysanthemum Leucanth	172	166	166	171	170	173	172	170	176	178	178
164	163	154	162	154		160	170	160	160	161	41. Nuphar advena	167	172	170	155	168	161		170	172	170	170
160	155	152	156	167	154	157	164	160	160	158	42. Rubus strigosus	165	171	163	160	161	174	157	163	165	167	167
	205	176				164	227	160	160	182	" " fruit ripe	193		220					170	227	175	175
159	167	168	171	176	172	172	174			170	44. Rhinanthus Crista-galli	174	168	173	172	172	183	172	175	178		
163	164	164	162	167	156	166	165	156	156	161	45. Rubus villosus	167	168	170	169	171	171	158	171	167	163	163
	229					179	249	165	165	197	" " fruit ripe	211		235	236				180	267	175	175
162	165	166	171	156		170	169			165	47. Sarracenia purpurea	171	168	172	169	185	161		172	171		
160	169		174	167		171	171	175	175	170	48. Brunella vulgaris	174	171	172		176	167		172	175	180	180
171	170	170	180	167	173	164		181	181	173	49. Rosa lucida	174	176	171	171	180	167	173	176	176		
163	161	165	169	165	171	170	174	178	178	169	50. Leontodon autumnale	175	172	168	172	173	173	178	176	171	182	182
	136		164	175		159	163	177	177	164	51. Linaria vulgaris	168		143		165	177		164	157	185	185
125	127	125	125	132	124	121	136	135	135	128	52. Trees appear green	141	139	139	139	138	146	136	136	153	142	142
142	132	131	137	143	143	135	146	149	149	141	53. Ribes rubrum (cultivated)	146	139	139	140	143	151	149	140	148	155	155
			187			212	208			201	54. " " (fruit ripe)	204				193			212	208		

VI. Phenological Observations, Canada, 1913.

Year, 1913

Day of the year corresponding to the last day of each month.

January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

When first seen											Year, 1913	When becoming common										
I. Yarmouth and Digby.	II. Shelburne, Queens, Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VIII. Cumberland, Pictou. Antigonish, Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.	Average Dates.		Average Dates.	I. Yarmouth and Digby.	II. Shelburne, Queens, Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VII. Cumberland, Pictou. Antigonish, Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.
129	136	138	140	147	143	137	148	155	155	143	55. R. nigrum (cultivated	148	139	140	141	146	154	148	142	153	156	156
			150				210			180	56. " fruit ripe	180				150				210		
130	136	131	142	150	150	141	152	155	155	144	57. Prunus Cerasus	150	141	141	137	149	156	156	145	158	159	159
	218		180			219				206	58. " " fruit ripe	206		218		180			219			
139	131	135	140	153	148	140	155	150	150	144	59. Prunus domestica	150	144	143	142	146	160	155	145	163	155	155
139	142	140	147	159	148	143	161	156	156	149	60. Pyrus Malus	157	149	152	149	154	165	156	150	166	164	164
158	156	153	156	165	158	155	170	166	166	160	61. Syringa vulgaris	166	164	162	160	163	171	162	161	173	171	171
162	156	160	160	161	160	159	170	159	159	160	62. Trifolium repens	165	166	163	162	164	167	166	170	174	173	173
146	149	157	157	160	165	161	170	167	167	160	63. Trifoluim pratense	165	157	158	161	162	168	173	169	171	173	173
173	162	158	164	158	164	169	167			164	64. Phleum pratense	170	173	166	165	171	163	169	176		173	173
	180	164	166	168		167		190	190	175	65. Solanum tuberosum	177		191	164	166	168		179		190	
106	107	109	119	114	115	119	114	110	110	112	66. Ploughing (first of season)	123	121	116	119	131	124	123	132	122	123	123
118	117	127	127	125	125	131	126	131	131	126	67. Sowing	134	127	126	134	134	133	138	143	138	137	137

117	114	131	132	123	129	133	119	121	121	124	68. Potato-planting	134	126	124	142	144	132	151	144	121	129	129
123	124	124	130	142	120	130	122	113	113	124	69. Sheep-shearing	133	130	133	135	140	147	133	145	133	121	121
170	173			167		212	216			187	70. Hay-cutting	198		189			167		216	223		
	251	238	288	238		238	256			251	71. Grain-cutting	264		264		309	246		242	260		
	261	267	295	275		271	273			274	72. Potato-digging	289		274		336	281		276	282		
59	87	76	75	80	75	75	92	85	85	79	73a. Openingof rivers											
74	101	80	89	90		98	99	85	85	89	73b. Opening of lakes											
107	147	105	112	106	122	121	126	131	131	121	74a. Last snow to whiten ground											
125	119	115	129	120	128	131	132	141	141	128	74b. " to fly in air											
115	129	119	143	138	160	133	143	152	152	138	75a. Last spring frost—hard											
151	157	140	157	154		160	174	159	159	157	75b. " " —hoar											
76	107	82	85	164	91	84	131	104	104	102	76a. Water in streams—high											
	269					259				264	76b. " " —low											
	256		287	295		240	248			265	77a. First autumn frost—hoar											
	302	259				279	295			284	77b. " " —hard											
333	305	277	304	304		303	304			304	78a. " snow to fly in air											
339	320	331	305	306		306	305			316	78b. " whiten ground											
	354			360			350			355	79a. Closing of lakes											
				349			349			349	79b. " rivers											
99	84	85	85	86	74	89	91	89	89	87	81a. Wild ducks migrating, N											
265	304						308			292	81b. " " S											
108	82	83	84	78	86	80	88	86	86	86	82a. " geese " N											
284	349	283				291	298			301	82b. " " S											
111	79	79	86	94	106	87	94	99	99	93	83. Melospiza fasciata, North											
80	76	68	79	73	62	79	70	85	85	75	84. Turdus migratorious "											
79	66	163	75	80	70	92	87	91	91	89	85. Junco hiemalis "											
121	117	100	131	123		124	139	117	117	121	86. Actitis macularia "											
	96	87	111			124	135	170	170	128	87. Sturnella magna "											
126	121	102	120	121	116	115	119	118	118	117	88. Ceryle Alcyon "											
118	157	104	130	152	117	134	137			131	89. Dendrœca coronata "											
120	140	133	134	151	124	140	148	131	131	135	90. D. æstiva "											
136	125	100	124	86	126	127	142	139	139	124	91. Zonotrichia alba "											
160	152	145	143	139	142	141	151	143	143	146	92. Trochilus colubris "											
110	160	106	131	131	145	141	160			135	93. Tyrannus Carolinensis "											
	144	104	134	140	86	136	125	124	124	124	94. Dolychonyx oryzivorus "											
94	145	91	138	120	141	144	143	118	118	125	95. Spinis tristis "											
	122	90	153	123		154	180	114	114	131	96. Setophaga ruticilla "											
	150			146	114	156		114	114	132	97. Ampelis cedrorum "											
113	137	125	123	121	115	138	141	142	142	130	98. Chordeiles Virginianus											
89	84	95	96	100	100	96	104	107	107	97	99. First piping of frogs											
80	93	106	108	106	107	109	110	116	116	105	100. First appearance, snakes											

80. THUNDERSTORMS.

Year, 1913	Observation Stations: I. Yarmouth and Digby.	II. Shelburne, Queens and Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VII. Cumberland, Pictou. Antigonish and Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.	Observation Stations: I. Yarmouth and Digby.	II. Shelburne, Queens and Lunenburg.	III. Annapolis and Kings.	IV. Hants and Colchester.	V. Halifax and Guysboro.	VI. Cobequid Slope. Chignecto Slope.	VII. Cumberland, Pictou. Antigonish and Colchester.	VIII. Richmond and Cape Breton.	IX. Victoria County.	X. Inverness County.	Year 1913
3^1 7^1 8^9		7^1						3^1										185^1			
12^2 13^2 14^1	8^2	8^6	8^1																		185^1
18^4 19^2		13^2		12^1	12^1	14^1															
		18^1		18^1	18^1	18^1															
26^2 27^3 31^1	31^1	26^1		19^1	19^1																
		27^2		26^1																	
								27^1													
39^1					39^1																
50^1					50^1																
53^3		53^2			53^1				63^1	63^1											
								64^1													
		65^1				65^1		65^1	65^1	65^1											
63^2 64^1																					
65^{10} 70^2		70^1						70^1										195^1			195^1
73^1 74^9							73^1											201^1			201^1
75^{11} 78^1	74^2	74^5		74^2														202^2			202.
					78^1		84^1	84^2													
88^1 90^1				87^1	88^1		90^1											216^1			
	95^1	95^3			95^1																
		105^1			96^1																216^1

			107^1		102^1																
95^5 96^1 102^1		108^1			107^3																
105^1 106^1 107^4																					
108^1 109^{26} 110^2	109^5	109^{19}	109^1	109^1														221^1			221^1
		110^1				110^1	111^1											222^2			222^2
111^1 115^4 116^1	115^1	115^1		115^1			115^1														
117^{20} 118^{27} 119^{10}		117^3	117^5	117^6		117^2	116^1														
		119^1		118^{12}	118^5	118^6	117^4														
	127	127^1		127^1	119^1	119^2	118^6														
		128^1			129^1		119^6														231^1
							121^1		121^1	121^1											
	134^1			134^2		134^1		133^1				231^1									
121^2 127^3				135^2			135^1														
128^1 129^1					138^1																239^4
133^1 134^4		139^1		139^{12}	139^4		139^9	139^1	139^4	139^4		239^2	239^2								240^6
135^3 138^1				140^2					140^1	140^1		240^1			240^1		240^3	240^1			242^1
139^{35} 140^4																	242^1				
146^2 147^1												246^1	246^1								246^2
																	247^1				247^1
												251^2	251^1				255^1	255^3			251^3
148^2 149^{17}																	270^1				255^4
			146^1				146^1							274^1							
153^{10}							147^1					275^1		275^1	275^1		275^1				270^1
157^3	149^5	149^7	149^5				148^2						276^1								
155^{23}											277^2	277^1									
156^3												286^1	281^1								274^1
157^1	153^1	153^5		153^2					153^1	153^1		289^2			289^1		289^1				275^7
							154^3														
158^6		155^{10}	155^3	155^3	155^5		155^1	155^1									295				276^1
			156^1														294^1				
159^3		157^1		156^2							300^1			301^1			301^1				277^3 281^1 286^1
160^1		158^1	158^2	158^2			158^1														289^4 290^1
		159^1		159^1			159^1				304^1						308^1				
164^1				160^1				164^1													294^1 300^1 301^2
165^3						165^2		165^1					311^1								304^1
167^{50}	167^4	167^{22}	167^7	167^7	167^5	167^1	167^1	167^1	167^1	167^1		314^1									
168^1		169^5			168^1									315^1							308^1 311^1
169^5		170^{10}	170^1	170^7	170^3		170^1		170^2	170^2											314^1 315^1
170^{26}		172^1		171^1																	
171^1		173^2			173^1			173^{10}	173^2	173^2		344^1									
172^1			174^1																		
173^{17}							176^1														
176^1		178^8	178^2	178^2	178^1	178^2	178^1														344^1
178^{16}							179^1														
179^1																					
181^1			181^1																		

APPENDIX D

DEPARTMENT OF INLAND REVENUE
LABORATORY BRANCH

BY

A. McGILL, B.A., B.Sc., LL.D., F.R.S.C.
Chief Analyst.

FEDERAL INSPECTION OF FOOD IN CANADA.

Since my last Report to The Royal Society, published in the Proceedings of 1913, the work of these Laboratories has been chiefly of routine character.

So far as Inspection of Foods, Drugs and Fertilisers is concerned, detailed account will be found in the following publications of the Department of Inland Revenue.

			Samples.
Bulletin No.	251	Cinnamon and Cassia	250
" "	252	Cloves (a study)	141
" "	253	Turpentine as a Drug	158
" "	254	Bran, Chops and Chop Feed	396
" "	255	Sweet Spirtis of Nitre	73
" "	256	Olive Oil	36
" "	257	Milk Powders, etc	45
" "	258	Maple Sugar	83
" "	259	Maple Syrup	128
" "	260	Bay Rum and Florida Water	70
" "	261	Tonic Wines	98
" "	262	Lime Fruit Juice	30
" "	263	Cream of Tartar	148
" "	264	Fertilisers	431
" "	265	Seidlitz powders	167
" "	266	Linseed Oil	53
" "	267	Meat Extracts	80
" "	268	Headache Powders	171
" "	269	Dried and Packaged Fruit	176
" "	270	Table Salt	139
" "	271	Mustard	167
" "	272	Lard	182
" "	273	Gelatine	161
" "	274	Lard and Substitutes	243
" "	275	Tomato Catsup	70
" "	276	Ice Cream	137

Much investigatory work having regard to the standardization of Foods under Section 26 of the Adulteration Act, has been done, and the following articles have been defined by Order in Council:—

	In Force.
Glucose Products (G.1064)	June, 1913.
Fruit and Products (G. 1080)	September, 1913.
Vinegar (G. 1096)	January 28th, 1914.

An Order in Council of 16th October, 1913, provides for the establishment of Sub-Laboratories, in organic connection with the main Laboratories at Ottawa, at the following places, viz: Halifax, Winnipeg and Vancouver.

It is hoped that these laboratories can be put into working order in the course of the year, and it is believed that they will fill a needed want, since the wide extent of our country from east to west, makes it practicably impossible to secure efficient inspection of foods and drugs until more localized points of analysis are available.

APPENDIX E

DEPARTMENT OF THE INTERIOR

FORESTRY BRANCH

FOREST PRODUCTS LABORATORIES

BY

W. B. CAMPBELL, B.Sc.

FOREST PRODUCTS LABORATORIES OF CANADA.

In addition to the lines of investigation previously carried on and reported to The Royal Society last year, the Forestry Branch has this year entered into a new phase of Forestry in this country by the institution of the Forest Products Laboratories.

For several years it has been felt that the government should do something to aid in the efforts to increase the efficiency of the utilization of our forest wealth. To do this two things are necessary—first, the present knowledge of the fundamental properties of our Canadian woods must be increased, and secondly this knowledge must be so presented as to point out to manufacturers methods by which they can utilize their material to better advantage.

The United States some few years ago being confronted with a similar problem, met it by organizing the Forest Products Laboratory at Madison, Wis. In view of the splendid results which they have obtained there it would seem that we in Canada would do well to adopt a similar, scheme, making only such modifications as are necessary to meet Canadian conditions.

The Canadian Laboratories are stationed at Montreal and affiliated with McGill University. Such affiliation will mean a great deal to the laboratories particularly in keeping the staff true to the ideals of the work; their addition will also be of no mean value to the University.

The first work undertaken by the new laboratories will be that of determining the mechanical and physical constants of the various woods grown in Canada, particularly those of commercial importance. These determinations will include such properties as strength, hardness, shock resistance, shrinkage and expansion with moisture content, specific gravity and also records of the characteristic structure of different varieties. As the data on these various items accumulate it is hoped it will be possible to correlate these properties by reference to some basic one. The recording of the characteristic microscopic structure will prove of considerable value in establishing methods of identification of woods.

Along with this will be carried on investigations of the use of wood in the manufacture of paper and other cellulose products. The fibre characteristics, methods of separating the fibres and of utilizing them, are all subjects which will well repay close scientific study. Later on it is expected that the laboratories will be able to take up the problems of preservation, wood distillation, etc., and also make some researches into the chemistry of the wood substance itself.

From this outline it will be seen that the work bids fair to be of considerable interest both from economic and scientific standpoints.

APPENDIX F

REPORTS OF ASSOCIATED SOCIETIES

REPORTS OF ASSOCIATED SOCIETIES.

I. Rapport du Club Littéraire Canadien-Français d'Ottawa.

Présenté par M. A. T. Genest, Président et délégué.

Fondé le 15 octobre 1908 sous les auspices de l'Institut Canadien-Français et le patronage de Sir Wilfrid Laurier, le Club Littéraire Canadien-Français d'Ottawa fut établi légalement le 15 décembre 1910, après sa désunion de l'Institut.

Le rapport que le Comité exécutif a l'honneur de vous présenter ci-après est le résumé des exercices du club depuis l'année dernière.

Les élections du Comité d'honneur et du Comité exécutif pour l'année 1913-14, ont donné le résultat suivant:—

Patrons.—Son Altesse royale le duc de Connaught, gouverneur du Canada; le Très honorable Sir Wilfrid Laurier, ex-premier ministre du Canada; Sa Grandeur Monseigneur C. H. Gauthier, archevêque d'Ottawa.

Présidents honoraires.—Le Très honorable L. N. Borden, premier ministre du Canada; l'honorable L. P. Pelletier, ministre des Postes; l'honorable Louis Coderre, secrétaire d'Etat; l'honorable Robt. Rogers, ministre des Travaux publics; le Très Honorable Sir Charles Fitzpatrick, juge en chef de la Cour Suprême; l'honorable sénateur N. A. Belcourt; l'honorable L. P. Brodeur, juge de la Cour Suprême; Monsieur E. B. Devlin, député de Wright.

Vice-présidents honoraires.—L'honorable C. J. Doherty, ministre de la Justice; l'honorable (colonel) Sam. Hughes, ministre de la Milice; l'honorable Geo. H. Perley; l'honorable sénateur W. C. Edwards; l'honorable J. O. Rhéaume, ministre des Travaux publics au parlement local; l'honorable juge A. Constantineau; MM. A. E. Fripp, M.P.; Napoléon Champagne, M.P.P.; J. A. Ellis; Auguste Lemieux, C.R.; Emmanuel Tassé; J. W. Harris; Lt.-col. F. Gourdeau; Michel G. LaRochelle, commissaire du Service Civil; M. J. Gorman, L.L.B., C.R.; C. A. E. Blanchet; Andrew Haydon.

Comité exécutif.

Président—M. Arthur T. Genest, ingénieur civil.
Vice-présidents—MM. Albert Allard, P.F.X. Genest, I.C.
Secrétaire—M. Richard T. Boult.
Trésorier—M. Alfred E. Lussier, avocat.

Conseillers—MM. Auguste Lemieux, C.R.; Vincent Perrin, I.C.; Bernadin Boutet, avocat; E. R. E. Chevrier, avocat; Chas. Bishop; Odilon Bédard.

Comité auxiliaire des dames.—Madame Allard, Madame C. E. Saunders, Mademoiselle A. E. Marty, Mademoiselle A. R. Aubry, Mademoiselle A. M. Turcot.

Conférencier—M. le chanoine LeBel, agrégé des Lettres de l'Université de Paris.

1913-1914.

Programme.

1ère partie.

Tartarin de Tarascon, de Daudet; *Mon oncle et nom curé*, de Jean de la Brète; *Le Roman d'un jeune homme pauvre*, d'Octave Feuillet; *La Cagnote*, de Labiche; *Le Disciple*, de Bourget, *Les Oberlé*, de Bazin; *La Colline inspirée*, de Barrès; *Pêcheurs d'Islande*, de Loti; *Le Monde où l'on s'ennuie*, de Pailleron, *La Cathédrale*, de Huysmans.

2ème partie.

Cours de logique. Théorie des termes, théorie des propositions, théorie des arguments: en dix leçons.

3ième partie.

Etude complète du théâtre de Corneille, en dix causeries.

Ce tableau indique que nous avons déja approfondi beaucoup de choses; mais nous n'avons fait qu'un pas cependant dans le domaine du savoir. Nous n'avons pu qu'entrevoir les splendeurs de l'univers à l'aide de la littérature qui, comme cette science a été si bien définie; "se rattache à tout, embrasse tout; où tout rentre et rayonne d'elle; qui est le centre unique d'où émanent les vérités universellement reconnues."

II.—Report of the Royal Astronomical Society of Canada.

Presented by DR. W. F. KING, Honorary President and Delegate.

During 1913, the number of meetings held at the various Centres

of the Society and the number of active members attached to each were reported as follows:—

Toronto, meetings held 17, active members 130.

Ottawa, meetings held 13, active members 90.

Peterborough, meetings held 12, active members 44.

Hamilton, meetings held 13, active members 34.

Guelph, meetings held 6, and a number of open air; active members 47.

Winnipeg, meetings held 10, active members 22.

Regina, meetings held 9, active emmbers 32.

These, with 23 Honorary Members make a grand total of 422.

The reports from the Secretary of each Centre together with the list of officers elected for 1914 are appended.

The following were elected officers of the Society for 1914:—

Honorary President—W. F. King, C.M.G., LL.D., Chief Astronomer, Ottawa.

President—J. S. Plaskett, B.A., D.Sc., Ottawa.

First Vice-President—A. D. Watson, M.D., Toronto.

Second Vice-President—A. F. Miller, Toronto.

Secretary—J. R. Collins, Toronto.

Treasurer—Chas. P. Sparling, Toronto.

Recorder—Lachlin Gilchrist, M.A., Ph.D., Toronto.

Librarian—Dr. W .M. Wunder, Toronto.

Curator—R. S. Duncan, Toronto.

Council—H. B. Collier, Toronto; Rev. I. J. Kavanagh, S.J., D.Sc., Guelph; Rev. Dr. Marsh, F.R.A.S., Peterboro; Stuart Strathy, Toronto; Sir Joseph Pope, K.C.M.G., Ottawa; Otto Klotz, LL.D., F.R.A.S., Ottawa.

These, with the Past Presidents and the presiding officers of each Centre, constitute the General Council of the Society.

Dr. R. E. De Lury, Secretary of the Ottawa Centre, reported as follows:—

Since the beginning of the year the Society has held thirteen regular meetings, eight in the Spring Series and five in the Fall Series. Of these, six were evening meetings as follows:—

Spring Term.

"Present Progress iñ Astronomy," by R. M. Stewart.

"How Knowledge Grows," by Dr. J. C. Glashan.

"Some Glimpses of the work along the 141st Meridian," by J. D. Craig.

"Astronomical Photography," by Frank Schlesinger.

Fall Term.

"The Work of the Dominion Observatory," by Dr. W. F. King.

"The Tides of Hudson Bay," by Dr. W. Bell Dawson.

Dr. Schlesinger's lecture was delivered in the Y.M.C.A. Hall, Dr. Dawson's in the Carnegie Library Hall and the others in the Dominion Observatory.

There were seven afternoon meetings as follows:—

Spring Term.

"Notes from the Cleveland Meeting of the Astronomical and Astrophysical Society of America," by J. S. Plaskett and R. M. Stewart; and "Longtitudes," by F. A. McDiarmid.

"The Grating Spectograph," by J. S. Plaskett; and "A New Form of Clock Synchronization," by D. B. Nugent.

"Review of Current Progress in Astronomy," consisting of:— "New Theories of Evolution of the Solar System," by T. H. Parker; "Some Peculiarities of the Helium Stars," by W. E. Harper; and "Some Problems in Geophysics," by Dr. Otto Klotz.

"International Boundary Surveys from the St. Lawrence to the St. Croix," by Thos. Fawcett.

Fall Term.

"The Bonn Meeting of the Solar Union," by Dr. J. S. Plaskett.

"A New Method for Solar Observations," by Dr. R. E. DeLury; and "The Undagraph," by Dr. Otto Klotz.

"First Experiences with the Time Service," by D. Robertson; and "Level Errors," by F. A. McDiarmid.

It will thus be seen that thirteen topics were dealt with in the afternoon meetings—which were all held in the Dominion Observatory Lecture Room—and following the custom, they were chiefly of a technical character. All the meetings were well attended and those attending were well repaid by the quality of the lectures.

During the year five members were elected and two resigned. The revised membership is now ninety. The Society has held a successful year and the prospects for the future are bright.

The following are the officers for the year 1914:

President—R.M. Stewart.

Vice-President—F. A. McDiarmid.

Secretary—R. E. DeLury.

Treasurer—D. B. Nugent.

Councillors—Thos. Fawcett, W. E. Harper, R. M. Motherwell.

These officers, together with Past Presidents, Dr. W. F. King, Dr. Otto Klotz, and Dr. J. S. Plaskett, constitute the committee.

T. H. Wingham, the Secretary of the Hamilton Centre, reported as follows:—

During the year six meetings were held with an average attendance of 54, as follows:—

Dec. 13, 1912—"Recent Convention of Astrophysical and Astronomical Society," Dr. Marsh.

Jan. 24, 1913—"How the Distances and Motions of the Stars are Determined," J. R. Collins.

Feb. 28—"Recent Visit to Greenwich," John A. Paterson.

Mar. 28—"Possibility of Life on Other Worlds," Harry Westoby.

April 26—"Celestial Photography," Professor Schlesinger.

May 30—"The Astronomical Yard-Stick," A. A. Hibner.

The election of officers resulted as follows:—

President—Wm. Bruce.

1st Vice-President—W. A. Robinson.

2nd Vice-President—Rev. J. J. Morton.

3rd Vice-President—Edgar Scholes.

Secretary—T. H. Wingham.

Treasurer—Seneca Jones.

Executive—Miss I. M. Walker, J. F. Harper, Mrs. J. F. Harper, J. J. Evel, J. M. Wllliams

Dr. D. B. Marsh, the Secretary of the Peterborough Centre, reported as follows:—

It affords me pleasure to report the year 1913 to be the best we have had. All fees were paid promptly and on January 1st, 1914, no less than half of the members paid up till end of 1914. There is a hearty interest among the members and several of our young men are looking toward an Astronomical Course in the University of Toronto—two intending to devote their lives to the study.

The Board of Education has generously supplied us with rooms, including light and heat, without charge.

The telescope so kindly loaned us by Mr. R. F. Stupart, Director of the Meteorological Service, is continually in use among the members; and the 3-inch telescope presented by Hon. J. R. Stratton has not been idle a week since it was donated two years ago.

The officers for 1914 are:—

President—T. A. S. Hay, C.E., Peterborough.

Vice-President—T. C. Elliot, Peterborough.

Secretary-Treasurer—T. C. Elliot, Peterborough.

Lantern and Slides—H. O. Fisk, Peterborough.

Care of Telescopes and Librarian—John Halliday Crane.

Members of Council—The above officers with Duncan Walker, B.A.; S. J. Keyes, B.A.; W. A. Logan, C.E.; D. E. Eason, B.A. Sc.; Henry Carveth.

Professor R. R. Graham, Secretary of the Guelph Centre, reported as follows:—

I have pleasure in forwarding the Annual Report of the work done by the local Centre of the Society during the year 1913. Six lectures were given during this time, all of which were much enjoyed, and they helped very much to sustain the interest in astronomy among our members.

The Society's six-inch telescope, Mr. H. E. S. Asbury has taken charge of, and he has been most kind during the year in setting it up for the benefit of others. Not only has he issued a standing invitation open to all our own members to visit his home to see through it, but he has invited many others, who are not yet members of the Society, and in this way has done a lot of good, creating interest in astronomy, and spreading knowledge.

The election of officers was left to a local committee, and they report as follows:—

Hon. President—Col. A. H. Macdonald, K.C.

Hon. Vice-President—Jas. Davison, B.A.

President—Henry Westoby.

1st Vice-President—Prof. W. H. Day, B.A.

2nd Vice-President—Dr. H. G. Roberts.

Secretary—Professor R. R. Graham, B.A.

Treasurer—H. J. B. Leadley.

Recorder—J. T. Luton, M.A.

Council—J. McNiece, B.A.; H. E. S. Asbury, Colonel D. McCrea, F. A. Graesser, Sheriff A. S. Allan, W. Laidlaw, Mrs. J. J. Drew, Miss Mary Mills.

Mr. C. E. Bastin, Secretary of the Winnipeg Centre, reported as follows:—

Our meetings have been held regularly during the year except during the summer months, when they were as usual discontinued except for occasional informal observation meetings.

Owing to the fluctuating nature of our population we lose a certain number of our members each year by removal to other cities, but these losses are replaced by new members so that our numbers remain about the same.

Officers for 1914:—

President—Prof. L. A. H. Warren, M.A., Ph.D.

Vice-President—H. C. Howard.

Secretary-Treasurer—C. E. Bastin, B.A.

Council—Rev. Father Blain, S.J.; Professor N. B. McLean, M.A.; Messrs. F. Powell, H. W. Malpass, J. H. Kolb.

III.—Report of the Women's Canadian Historical Society of Ottawa.

Presented by MRS. J. B. SIMPSON, Hon. Rec. Sec., Delegate.

The season of 1913-14 is replete with anniversaries and centenaries in our Canadian history from victories of war to victories of peace. Stoney Creek and Chryslers Farm, to the Treaty of Ghent, the Peace Centenary, all of which is especially dealt with in this year's work of our Society.

During the season 14 meetings have been held, 6 general and 8 executive. The Annual Report for 1912-13 has been published, and reprint of Vol. I urgently requested. Our Treaty Series, the papers for Vol. VI will not be completed till next season.

Representatives from our Society attended the Stoney Creek and Chrysler's Farm Centennials; and reports were read at the Annual Meetings of the Royal Society of Canada in Ottawa; the Ontario Historical Society, Chatham; the American Historical Ass'n, Charleston, N.C., and the Local Council of Women.

The first meeting was addressed by J. S. Carstairs, B.A., on the United Empire Loyalists; and the following papers were prepared and read by members of the Society at the general monthly meetings:—The Stony Creek Centennial—unveiling of monument by Queen Mary from Buckingham Palace, by our President, Mrs. Thos. Ahearn; Report of Ontario Society's Annual, by Mrs. Billings; Treaty of Ghent, Miss Muriel Shortt; Centenary Celebration of Chrysler's Farm, Miss Eva Read; Regime of Sir Charles Metcalfe and Lord Elgin, Mrs. J. Lorne McDougall; the Ashburton Treaty, Miss Hazel Biggar; Reciprocity Treaty, 1854, Mrs. W. P. Davis; Account of an Old Cairn on Squaw Island in Lake St. Francis, Miss Mary Masson; and Some Reminiscences of Confederation, by Mrs. Walter Armstrong.

Through the efforts of the Society a small beginning has been made, and the City's first tangible recognition of its Founder, a portrait bust of Lt. Col. John By, R.E., is now in place of honour in the Council Chamber of the City Hall. While their ideal project, the monument symbolical of the Confederation of the Provinces, the birth of our Dominion, is about to materialize most appropriately on Connaught Place, the centre of the Capital of the Dominion of Canada. A hearty personal tribute to our Society's efforts in that

direction was received from the last remaining "Father of Confederation," Sir Charles Tupper, when visiting our Capital en route for England, last April.

Our corresponding secretary, Mrs. Billings, has had extensive and interesting correspondence both far and near, including kindly appreciation from our gracious Patroness, H.R.H. the Duchess of Connaught.

The statement of our treasurer, Miss Rothwell, shows receipts (including annual grant from the provincial government of $200.00) $337.12, expenditure $174.87, balance $162.25.

Our librarian, Miss Read, reports valuable additions in records and books received during the past year—membership 207.

A list of publications and exchanges is embodied in our printed report.

May 27th, 1914.

IV.—Report of the Ottawa Field Naturalists' Club.

Presented by E. D. Eddy, Secretary.

The Council of the Ottawa Field Naturalists' Club has much pleasure in presenting to the Royal Society of Canada the following report on the work of the Club during the year ending March, 1914.

Membership.

The present membership of the Club is 317; 311 ordinary members and 6 corresponding members.

Branches of the Club.

Botanical Branch. Six meetings of the Branch were held at the homes of the members during the winter of 1913-14. The subjects presented and discussed were:—

Some Results of the Summer's Work, by Dr. M. O. Malte.

Some Conditions affecting Organic Progress, by C. J. Tully.

The Clay Belt of Northern Ontario, by G. H. Clark and Mr. Honeyman.

A Review of some Recent Work dealing with the Phenomenon of Variation in Plants, by L. H. Newman.

The Wild Fruits of Canada, by W. T. Macoun.

Entomological Branch. Five meetings were held during the winter, at which various subjects relating to insect life were discussed.

At these meetings many specimens were placed on exhibit. During the collecting season large collections of the insects of the Ottawa District were made.

WINTER SERIES OF LECTURES.

The following programme of public lectures was carried out:—

Nov. 25—Open meeting, with exhibits and addresses by members.

Dec. 9—The Old Iroquoian Religion and the Handsome Lake Reform (illustrated), by C. M. Barbeau, Assistant Ethnologist, Geological Survey.

Jan. 13—Forestry and Conservation (illustrated), by Dr. Clyde Leavitt, Commission of Conservation, Ottawa.

Jan. 27—The Shedding of Leaves, Flowers and Fruits (illustrated), by Dr. Francis E. Lloyd, Department of Botany, McGill University, Montreal.

Feb. 10—Protection of Birds In and Around Ottawa (illustrated), by Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.

Feb. 24—Views in the Dominion Parks (illustrated), by A. Knechtel, Chief Forester of Dominion Parks, Ottawa.

Mar. 10—Mackenzie River Region (illustrated), by Charles Camsell, Geologist, Geological Survey, Ottawa.

Mar. 24—Annual Meeting and Presidential Address on the Breeding of Economic Plants, by L. H. Newman, Secretary, Canadian Seed Growers' Association, Ottawa.

SPRING AND AUTUMN EXCURSIONS.

A feature of the work of the Club is the outings held during the spring and autumn months. At these excursions the attendance varies from 30 to, occasionally, several hundreds. The following field outings were held in 1913:—

Spring and Summer Series:

May 3—Rockcliffe and McKay's Lake.
10—Leamey's Lake.
17—Britannia.
31—Aylmer.
June 7—Points along Rideau Canal by motor boats.
14—Stittsville.

Fall Series:

Sept. 20—Billings Bridge.
27—Experimental Farm.
Oct. 14—Beaver Meadow.

PRESERVATION OF BIRD LIFE.

On February 10th, Dr. C. Gordon Hewitt, at a public meeting of the Club, outlined a scheme for the establishment of two bird sanctuaries for the Ottawa district, one at Rockcliffe and the other at the Central Experimental Farm. At the former it was decided to put out 250 nesting boxes, and at the latter 160. (See Ottawa Naturalist, March, 1914).

THE OTTAWA NATURALIST.

Under the editorship of Mr. Arthur Gibson, the Club completed Volume XXVII of its official organ, the Ottawa Naturalist. Ten numbers were issued (two of which were double numbers) comprising 180 pages in addition to which there were 23 plates. The following are some of the chief papers which appeared in the volume:—

Notes on the Occurrence of Interesting Forms of Cyperaceae in Quebec, by Bro. Victorin, Longueuil, Que.

Preliminary List of Ottawa Sphaeriidae, by F. R. Latchford.

The Manus in a Specimen of Trachodon from the Edmonton Formation of Alberta, by L. M. Lambe.

The Shade Trees of Ottawa, by E. H. Blackader.

Useful Wild Plants of Canada, by J. W. Eastham.

Description of a New Species of Testudo, and of a Remarkable specimen of Stylemys nebrascensis from the Oligocene of Wyoming, U.S.A., by L. M. Lambe.

The Broad-striped Skunk, by Norman and Stuart Criddle.

Does the Type of Protopalaeaster narrawayi Present an Oral or Aboral Aspect, by G. H. Hudson.

The Haunts of Some of Our Native Ferns, by. A. Cosens.

On the Genera of the Eodiscidae, by P. E. Raymond.

A New Genus and Species of Ceratopsia from the Belly River Formation of Alberta, by L. M. Lambe.

New and otherwise Interesting Lichens from Vancouver Island and the Rocky Mountains, by G. K. Merrill.

Some Rare Cases of Albinism in Animals, by E. E. Prince.

On the Fore-limb of a Carnivorous Dinosaur from the Belly River Formation of Alberta, and a New Genus of Cera-

topsia from the Same Horizon, with Remarks on the Integument of Some Cretaceous Herbivorous Dinosaurs, by L. M. Lambe.

On Gryposaurus notabilis, a New Genus and Species of Trachodont Dinosaur from the Belly River Formation of Alberta, with a Description of the Skull of Protorosaurus belli, by L. M. Lambe.

Notes on the Apothecial Stage of Sclerontinia cinerea in Ontario, by J. E. Howitt.

The Protection of Birds In and Around Ottawa, by C. Gordon Hewitt.

Council.

The present Council of the Club is as follows:—

President—Mr. Arthur Gibson.

Vice-Presidents—Mr. H. I. Smith, Dr. C. Gordon Hewitt.

Secretary—Mr. E. D. Eddy.

Treasurer—Mr. J. F. Watson.

Editor—Mr. Arthur Gibson.

Librarian—Mr. J. R. Fryer.

Members of Council—Messrs. J. W. Gibson, W. T. Macoun, J. J. Carter, Andrew Halkett, J. R. Dymond, Drs. M. O. Malte, M. Y. Williams, Mrs. W. D. Oakely and the Misses A. L. Matthews and F. Fyles.

V.—The Entomological Society of Ontario.

Presented by Henry H. Lyman, M.A., F.R.G.S., F.E.S., Montreal, Delegate.

The Entomological Society of Ontario, having been founded in 1863 as the Entomological Society of Canada, which designation was changed on its incorporation in 1871, to the present style, completed its 50th year of existence last year, and it was felt that so interesting an event in the history of the second senior Entomological Society of this continent should be fittingly celebrated. Very appropriately the Rev. Dr. Bethune, Professor of Entomology and Zoology of the Ontario Agricultural College at Guelph, one of the four surviving original founders of the Society, its second Secretary and an early President, and the editor of 28 volumes of the Canadian Entomologist, was recalled to the Presidential Chair to preside over the Jubilee Annual Meeting.

The meeting was held Aug. 27th-29th, the members and delegates from a distance being entertained in the Macdonald Hall of the Agricultural College, and many delegates were present representing leading universities and important scientific societies, among whom may be mentioned Prof. J. H. Comstock of Cornell University, also representing the Entomological Society of London, Prof. F. M. Webster of the Bureau of Entomology, Washington, D.C., also representing the Entomological Society of Washington, Dr. R. Stewart MacDougall of the University of Edinburgh and the Imperial Bureau of Entomology, Mr. Geoffrey Meade-Waldo of the British Museum (Natural History), Dr. E. P. Felt, State Entomologist of New York, also representing the New York Entomological Society, Prof. W. M. Wheeler of Harvard University, and the Boston Society of Natural History, Dr. C. Gordon Hewitt, Dominion Entomologist, also representing the University of Manchester, the Royal Society of Canada and the Academy of Natural Sciences of Philadelphia, Prof. T. J. Headlee, State Entomologist of New Jersey, Prof. P. J. Parrott, President of the American Association of Economic Entomologists, Prof. A. D. MacGillivray, the Secretary of the Entomologiacl Society of America, Prof. Wm. Lochhead of Macdonald College and McGill University, Dr. E. M. Walker of the University of Toronto, Mr. A. Gibson, representing the Ottawa Field Naturalists' Club, Mr. H. H. Lyman representing the Montreal Branch of the Society, Dr. A. Cousens representing the Toronto Branch of the Society, Mr. R. C. Treherne representing the Entomological Society of British Columbia, Mr. J. C. Chapais, the Quebec Society for the Protection of Plants, Prof. J. J. de Vyver of the Entomological Society of New York, Rev. Dr. T. W. Fyles, Fellow of the Linnean Society, Mr. J. B. Williams, F.Z.S., of the University Muesum, Toronto, Mr. J. D. Evans, C.E., Trenton, Ont., Mr. F. J. A. Morris, Peterboro, Prof. J. Dearness, London, Ont., Mr. J. F. Brimley, Grimsby, Ont., Mr. F. W. L. Sladen of the Division of Entomology, Ottawa.

The Ontario Agricultural College was represented by President Creelman, Prof. C. J. S. Bethune, Prof. T. D. Jarvis, Prof. C. A. Zavitz, Prof. E. J. Zavitz, Prof. Hutt, Prof. Crow, Mr. L. Caesar, Mr. A. W. Baker, Dr. R. E. Stone, Messrs. Wright, Spencer, Burrows, Curran, Good, Hart and others.

Messrs. Sanders, Tothill, Petch, Ross, Hudson and McLaine, Field Agents of the Dominion Division of Entomology, were also present.

A message of congratulation from Dr. William Saunders, one of the original founders of the Society, who was too ill to be present, was conveyed to the Society by his son, Mr. W. E. Saunders, who was long the Secretary of the Society.

Letters of congratulation were also received from the following: The Imperial Academy of Natural Sciences of St. Petersburg (by cable) the Vice-Chancellor of the University of Oxford, the Vice-Chancellor of the University of Cambridge, the President of Laval University, Quebec, Dr. Walter Horn, Director of the German Entomological Museum, Berlin, Mr. J. P. Moore, Secretary of the Academy of Natural Sciences of Philadelphia, Mr. G. A. Dean, Kansas State Agricultural College, Mr. E. B. Reed of the Dominion Meteorological Station, Victoria, B.C., one of the founders of the Society, Dr. L. O. Howard, Chief Entomologist, Washington, D.C., the Trustees of the British Museum (Natural History) the University of Chicago, Mr. N. H. Cowdry of Chicago, an early member, Mr. A. Ross, Secretary Natural History Society of Glasgow, Mr. G. A. Marshall, Imperial Bureau of Entomology, Mr. G. F. Dow, Secretary Essex Institute, The California State Commission of Horticulture, Prof. T. D. A. Cockerell, Prof. H. Garman, and Prof. H. F. Wickham, University of Iowa, and from the President and Secretary of your own Society.

The meetings extended over two days at Guelph, the first day being concluded by a most enjoyable informal evening reception by President and Mrs. Creelman, while on the second evening a most interesting and instructive illustrated lecture on Ants was given by Prof. W. M. Wheeler, while the third day was devoted to an excursion to Grimsby, where the application of economic entomology to fruit growing was examined or the visitors went on a collecting ramble.

The progress of the Society during the 50 years of its existence has been very marked. It began with a membership of about 15, but now has nearly 200 on its membership roll, and the high standard of the Canadian Entomologist has been well maintained, the 45th volume of which was completed at the end of the year and extends to 438 pages, while the first volume only extended to 110, and the contributors of papers numbered 58, including besides our own Canadian members, many well known entomologists of the United States, two residing in Australia, and one each in Finland, Hawaii, Japan, Peru, and the Canal Zone, 14 genera, 117 species, 1 sub-species and 4 varieties were described as new to science in the volume, and it was illustrated by 17 plates, two being groups of entomologists, besides illustrations in the text.

Since the removal of the headquarters of the Society from London to Guelph, it has been housed in the buildings of the Ontario Agricultural College, but unfortunately in different buildings, its valuable library being in the library building, its collections in the College Museum, and its meetings held in the biological class-room, but it is now realized that this arrangement is by no means ideal, and that in

no way could the fiftieth anniversary be more fittingly commemorated than by the erection of a separate building for the exclusive use of the Society, where its library and collections could be brought together in close proximity to the meeting room, and it has been suggested that such a building might very appropriately be named Bethune Hall after the venerable and venerated Prof. of Entomology at that College, who has done so much to advance the study of Entomology in Canada.

VI.—Report on Huron Institute, Collingwood.

Presented by DAVID WILLIAMS, Sec.-Treas.

Since the last Annual Report, the Huron Institute has continued its good work. As in the preceding year, attention has been directed largely to the museum, which has attained such proportions that a few months ago the Executive found it necessary to seek increased accommodation. In doing so they were cordially met by the Board of the Public Library, which readily placed another large room at the disposal of the Institute. This is now occupied, and already the walls are well covered with maps, pictures and documents, which have come into the possession of the organization. Of these special mention must be made of a collection of upward of seventy-five photographs of "Old Boys," all neatly framed in individual frames. The number will be added to from time to time, and in them the Institute feels that it has much that is valuable in the way of local history. To lend a further interest to the pictures, and at the same time to place on record the story of those who have gone out from the town, it is the intention to include copies of them, with individual sketches, in the next volume of Papers and Records. The publication will also include some reminiscences by a number of the older residents.

In the main part of the museum another large display case has been installed at a cost of about twenty dollars. This will soon be filled, and it is probable that further additions will be made during the year. New exhibits are coming in from time to time, many of them being of great interest to local historians.

During the year the Institute has had a fair number of visitors, among others may be mentioned Prof. O. Skelton of Queens University, William Houston, M.A., of Toronto, and Prof. C. A. Chant of the University of Toronto, all of whom expressed themselves as surprised at the extent of the collection, and congratulated the Institute on the material evidence of its success.

The officers for the current year are:—

Hon. President—F. T. Hodgson.

President—M. Gaviller, C.E.

Vice-Presidents—Mrs. J. R. Arthur and Miss F. A. Redmond.

Secretary and Treasurer—David Williams.

Curator—G. W. Winckler, C.E.

Directors—Messrs. John Birnie, K.C., F. F. Telfer, G. B. Wescott, G. W. Winckler, C. E. , Rev. Dr. O'Leary, Misses M. Howard and E. Griesbach.

FINANCIAL STATEMENT.

Receipts:

June 1/13—To	balance	$138.96	
	Govt. Grant	100.00	
	Interest	5.65	
	Membership	1.50	$246.11

Expenditures:

Sept. 1/13—By	Stationery	$ 5.25	
	Ont. Hist. Society	37.00	
	Framing pictures	11.12	
	Furniture for museum	21.75	
	Sundries	2.20	
	Insurance	4.90	
	Lighting	12.00	
	Balance	151.89	
			$246.11

All of which is respectfully submitted.

DAVID WILLIAMS,
Sec.-Treas.

Collingwood,
May 1st, 1914.

VII.—Report of the Women's Canadian Historical Society of Toronto.

Presented by Miss HELEN MERRILL, Delegate.

We are pleased to report that this Society has 177 members, and after expenses for Printing, &c., have been paid, we still have $38.24 on hand. Transaction No. 12 included the Report ending Nov. 16th, 1913, and two papers—one on Roads, by Miss K. M. Lizars, illustrated by rare maps, and the Diary of John Goldie, a

botanist, who walked along the shore of Lake Ontario from Kingston to Niagara in 1819; also a short sketch of the life of Mrs. Agnes Dunbar Chamberlain. Our meetings have been well attended and the following papers have been read:—

Extracts from the Diary of the late Capt. Vidal, read by his granddaughter, Mrs. Gardiner.

An assessment paper of the York District, 1798.

Pay sheet of the expenses of the Lighthouse on Gibralter Pt., from the McCutcheon Papers, 1817.

Recollections of the War of 1812, by Hon. James Crooks, read by his grandson, Mr. A. D. Crooks. Two letters written after the battle of Stoney Creek, by Col. Fitz Gibbon, read by Dr. Alex. Fraser.

The overland migration of U. E. L., by Mr. Stewart Wallace of McMaster University.

Reminiscences of Pauline Johnson, by Mrs. Duckworth.

Two interesting papers on Sir Geo. Yonge and Henry Dundas, after whom Yonge St. was named, and town of Dundas after Sir Henry Dundas, written by the late Dr. Scaddin, and read by his daughter, Mrs. Sullivan.

Extracts from Diary of late Capt. Wright, R.N., compiled by his granddaughter, Mrs. Gardiner,

A Political Squib (author unknown), written in 1845, and printed in pink satin on Responsible Government.

There are in our library some 100 bound volumes and many pamphlets and magazines, for which safe keeping this Society earnestly desires a permanent home. Provisional meetings have been held to try to co-operate with other societies with the end in view of building a place for the pictures and documents which we have on hand—$5,000 under the name of Queen Victoria Memorial Fund,—but, though no scheme has yet been put forth, we hope each year brings this object nearer its completion.

All of which is respectfully submitted.

VIII.—Report of United Empire Loyalists' Association of Canada.

Presented by Miss Helen M. Merrill, Honorary Secretary.

The United Empire Loyalists' Association of Canada is the oldest British historical and patriotic society organized in America now in existence.

This Association had its inception in Boston, October 28, 1775, when, at the suggestion of General Gage, a society was formed under

the name of "The Loyalist Association Desiring the Unity of the Empire." On October 1, 1894, ten years after the centenary celebration of the landing of the Loyalists in Upper Canada, Colonel G. Sterling Ryerson, M.D., advocated through The Empire, now The Mail and Empire, that the association be reorganized. His proposal apparentlv did not immediately meet with sufficient support.

On the 28th of February, 1896, however, a meeting was called and a committee appointed to draft a constitution, and on May 11 the first general meeting was held. The Hon. John Beverley Robinson was elected President, and Lieut.-Col. W. Hamilton Merritt, Secretary.

Following the death in June of the same year of the President, he was succeeded by Colonel Ryerson, who in turn was succeeded by Mr. H. H. Cook, Mr. A. McLean Howard, Sr., Mr. R. E. A. Land, Rev. C. E. Thomson, Mr. E. A. Maclaurin, Rev. Canon A. W. Macnab, Mr. J. Stewart Carstairs and Major W. Napier Keefer. In March 1912, Colonel Ryerson was again elected President, by acclamation, and still continues in office. Under his Presidency the association, more or less inactive for a time, has revived, and is making marked progress. He is an able and enthusiastic officer, and one who lends distinction to whatever position he holds.

The objects of the United Empire Loyalists' Association of Canada are:—

1. To unite together, irrespective of creed or political party, the descendants of those families who, during the American revolutionary war of 1775 to 1783, sacrificed their homes in retaining their loyalty to the British Crown, and to perpetuate this spirit of loyalty to the Empire.

2. To preserve the history and traditions of that important epoch in Canadian history, by rescuing from oblivion the history and traditions of the Loyalist families before it is too late.

3. To collect together in a suitable place the portraits, relics and documents relating to the United Empire Loyalists, which are now scattered throughout the Dominion.

4. To publish an historical and genealogical journal or annual transactions.

At the present time the Association is particularly interested in increasing its membership and establishing branches in all parts of Canada. A branch last year was established in Edmonton, with Mrs. J. Bryce Saunders as its President. Mr. E. B. Merrill, Moose Jaw, who was interested in forming a branch there, wrote: "The immigration of the Loyalists was certainly a great event for Canada and the Empire. The Loyalists built Ontario and the eastern Provinces, and Ontario and the eastern Provinces have built, or permeated, Man-

itoba and the other western Provinces. There are, of course. a great many foreigners and Americans here in the west, but the influence of Ontario, the influential men, the politics, prevail. The United Empire Loyalists not only saved Canada for the Empire a hundred years ago, but their influence and their feeling still pervade it."

At the close of the Revolutionary War, between thirty and forty thousand Loyalists settled in Canada. Previously the British population had not exceeded 12,000. The French population was nearly 100,000. By 1837-1838 the U. E. Loyalist population constituted upwards of one-seventh of the total population of the Dominion. The possibilities for increase of membership in the Association are obvious.

Frequently enquiries have been made as to who are eligible for membership. An Order in Council, under Lord Dorchester, dated at Quebec, 9th November, 1789, which is practically the Charter of the Association, is explicit respecting qualification. On an attached form for registration of Loyalists is the important note:—

"N.B.—Those Loyalists who have adhered to the Unity of the Empire, and joined the Royal Standard before the Treaty of Separation in 1783, and all their children and their descendants by either sex, are to be distinguished by the following capitals, affixed to their names:—

U. E.

Alluding to their great principle—
The Unity of the Empire."

During the past year the United Empire Loyalists' Association of Canada held eight meetings including the annual luncheon on May 21st, instant. In June, 1913, delegates were invited to attend the unveiling of the Monument on the battlefield at Stony Creek, and in September the Centennial Celebration to Tecumseh at Thamesville. In January the Constitution was amended to admit of the election to honorary membership of those who render distinguished service to the Association, and Mr. Wilfred Campbell, LL.D., F.R.S.C., Ottawa, and Mr. James Henry Stark, Boston, author of "The Loyalists of Massachussetts," elected Honorary Members. Provision was made for the election of a Standard Bearer, and Miss Laura Ryerson elected; also for two or more auditors, followed by the election of Mr. E. A. Maclaurin and Lt.-Col. Fred Macqueen. Sixty-six new members have been elected including the Hon. Hector Mansfield Howell, Chief Justice of Manitoba, as an Honorary Vice-Presi-

dent. The Constitution and By-Laws have been revised and 500 copies published, and handsome certificates of membership engraved. A catalogue of the Accessions of the Association has been made and copies of the Transactions on hand assorted. A few have been sold at $1.00 per copy. Volumes I and II are out of print. Two sets including I and II have been bound for the library.

During the present Session of the Dominion Parliament at Ottawa, incorporation of the Association was obtained by special Act under the title of *The United Empire Loyalists' Association of Canada.*

On the 21st of May, instant, a very successful and enjoyable luncheon was held at the King Edward Hotel, Toronto, to celebrate the 130th anniversary of the landing of the Loyalists at St. John, N.B. Colonel Ryerson presided. T.R.H. the Duke and Duchess of Connaught and the Princess Patricia were guests of honour. More than 150 members and friends were present. Letters of regret at not being able to be present were received from the Right Honourable R. L. Borden, Premier of Canada, Hon. Sir James and Lady Whitney, Colonel Hugh Havelock McLean, St. John, N.B., Hon. R. P. Roblin, Winnipeg, etc., also a telegram from the Ven. Archdeacon W. O. Raymond, Historian, and from the New Brunswick United Empire Loyalists' Society, St. John.

Brief patriotic and historical addresses were delivered by His Royal Highness the Duke of Connaught, Colonel Ryerson, Colonel Denison and Sir John Willison, etc. T.R.H. the Duke and Duchess of Connaught and the Princess Patricia were elected Honorary Members, and Mrs. J. Bryce Saunders, Edmonton, Honorary Organizing Secretary for the West, after which those attending the luncheon were presented to Their Royal Highnesses by Colonel Ryerson.

Since last October the following papers and addresses have been given:—

The U. E. Loyalists of Adolphustown, by Mr. A. R. Davis, C.E.
U. E. Loyalists and why they remained loyal to the British Empire, by Mr. James Henry Stark, Boston.
The Iroquoian Loyalists, by Mr. F. O. Loft.
Pioneers of a Century of Peace, by Dr. E. Herbert Adams.
Hungary and the Hungarians (illustrated), by Colonel Ryerson.
Judge Mitchell and Early Days in the London District, by Mr. C. E. Macdonald.
The Loyalists' Migration Overland, by Mr. W. S. Wallace.
David Barker, U.E., of Adolphustown, by Mrs. R. Stearns Hicks.

The Officers, Council and Committees for 1914 are as follows:—

Officers, 1914.

President.—Colonel G. Sterling Ryerson.

Vice-Presidents.—Colonel G. T. Denison; E. B. L. Hill, Vancouver, B. C.; Colonel Hugh Havelock McLean, St. John, N.B.; R. S. Neville, K.C.; Mrs. Dignam.

Honorary General Secretary.—Miss Helen M. Merrill.

Honorary Treasurer.—A. R. Davis.

Standard Bearer.—Miss Laura Ryerson.

Honorary Legal Adviser.—C. E. Macdonald.

Honorary Genealogist.—E. M. Chadwick, K.C.

Honorary Chaplain.—Rev. Canon A. W. Macnab.

Central Council.—Rev. Canon Alfred Brown, Halifax; George H. Ham, Montreal; Colonel A. H. Macdonald, Guelph; Sir John Beverley Robinson, Edgewater, N.J.; Lt. Col. J. J. Gregory, Lacombe, Alta.; Mrs. J. J. Gemmel, Ottawa; Albert J. Hill, New Westminster. Lieut.-Colonel R. W. Gregory, St. Catharines; H. S. Seaman, Winnipeg; Lt. Col. H. C. Rogers, Peterborough; E. B. Merrill, Moose Jaw; Lt. Col. Wm. Hamilton Merritt, Toronto; L. V. Chipman, Annapolis Royal, N.S.; Hugh Munro, M.P.P., Alexandria.

The following ten Members of Council with the Officers form the Executive Committee:—

Major W. N. Keefer, E. A. Maclaurin, Lt. Col. F. Macqueen, Captain V. A. Hall, J. S. Carstairs, F. O. Loft, Lt. Col. G. A. Shaw, Miss Catharine Merritt, Mrs. R. Stearns Hicks, Mrs. Edmund Phillips.

Investigating Committee.—Colonel Ryerson, Miss Merrill, A. R. Davis.

Publishing Committee.—The President, the Secretary, the Treasurer.

Ladies Committee.—Mrs. R. A. Payne, Mrs. Forsyth Grant, Miss Laura Clarke, Dr. Amelia Johnston, Mrs. J. D. Tyrrell, Miss Strathy, Mrs. R. W. Hicks, Mrs. Norman Allen, Miss Deeks, Miss Dickson, Miss Carey, Mrs. Law.

IX.—Report of the Canadian Forestry Association.

By Jas. Lawler, Secretary.

The work of the Canadian Forestry Association in its effort to arouse public opinion to the need of forest conservation and rational forest development was pressed vigorously forward in 1913. The Association carries on its work by the spread of literature, the deliver-

ing of free illustrated lectures and by the holding of Conventions in different parts of Canada. The literature and lecture work goes on steadily with an ever increasing field, but without change to note from year to year. On the other hand, the most notable feature of each year's work is the Convention. Each year a different part of Canada is selected for this gathering, and every effort is made to adapt the program to the needs of the Province and district in which the Convention is held.

In 1913 the experiment was tried of holding the Convention in the City of Winnipeg. Many felt that this was attended by a very considerable risk since the general impression is that there are no forests on the prairies, and, therefore, that the people of Central Canada would not be interested and would not attend.

On the contrary, however, the Convention proved both that the prairie Provinces contained a great deal of timber, which because of its nearness to a large farming population is of great value and that the public was interested in the question. It was also shown that the rate of growth in these Provinces was quite equal to that in some European Countries, which have made a great success of Forestry. This was brought out particularly in the paper of Mr. R. H. Campbell, Dominion Director of Forestry, which paper was entitled "Manitoba: A Forest Province." In it he compared Manitoba's Forest Resources with those of Sweden, showing that the advantages were on the side of Manitoba. Tree planting on the prairies, which under the direction of the Dominion Forestry Branch has resulted in the setting out of over 23,000,000 trees, was also gone into at length, and the relations of forestry to prairie agriculture fully discussed.

The Convention was participated in by representatives of the forestry, lumbering, agricultural, railway, banking and commercial interests and aroused great interest throughout Central Canada.

Two exhibits added much to the value and interest of the Convention. The first of these was a display of native woods of Manitoba, collected and arranged by the Dominion Forestry Branch. The size and value of the oak, spruce, pine, poplar, elm, willow and other trees was a great surprise to most of those who visited the exhibit and gave them a new conception of the value of those forests within the bounds of the Prairie Provinces. The other exhibit was that of insects injurious to the forest, prepared by the Dominion Department of Entomology, Ottawa. This subject has become so important that the exhibit was constantly surrounded by lumbermen and others who were concerned to learn what could be done to protect their property from the ravages of these insects.

The Association has continued to press forward its aims, par-

ticularly the effort to have all the field forces engaged in forest protection, both under the federal and provincial governments placed under civil service regulations. While the advance has not been startling, steady progress is being made in the different fields of activity and it is expected this will be no less marked in 1914 when the peculiar problems of Nova Scotia forests will be dealt with at a Convention held in Halifax, September 1-4.

X.—Rapport de la Société de Géographie du Canada.

Présenté par M. EUG. ROUILLARD, Secrétaire-Général et Délégué.

La Société de Géographie de Québec est entrée dans la 37ème année de son existence, ce qui est déjà un fort bel âge pour une institution de ce genre.

Il nous fait plaisir de dire que le nombre de personnes qui s'intéressent au mouvement géographique dans notre pays augmente sans cesse. Chaque année la Société reçoit d'importantes adhésions, et à l'heure actuelle nous comptons près de 450 adhérents.

Il est à noter que la plupart des grandes maisons d'éducation du pays reçoivent aujourd'hui le *Bulletin* publié par la Société.

Le nombre des collaborateurs du Bulletin s'est lui-même accru. Nous devons déjà d'importants travaux à quelques-uns d'entre eux, notamment à M. Benjamin Sulte, de la Société Royale du Canada, à M. l'abbé Adolphe Garneau, professeur au Séminaire de Quebec, à M. John M. Clarke, directeur du State Museum d'Albany, N.Y., au Rév. Frère Victorin, de Longueuil, qui est un des naturalistes les plus distingués de la Province, à M. l'abbé Yvanhoé Caron, qui a publié une série d'études sur le territoire de l'Abitibi, à M. Avila Bédard, ingénieur-forestier, à la Commission de Géographie de Québec qui nous donne la primeur des dénominations géographiques dans les nouveaux territoires explorés, à M. J. M. Barbeau, anthropologue de la Commission de Géologie d'Ottawa, à M. F. X. Fafard, arpenteur-géomètre.

Le Bulletin a commencé aussi depuis plus d'un an la publication d'un Dictionnaire des Lacs et Rivières de la Province de Québec, avec des indications précises sur l'étendue de ces cours d'eau, sur leur situation, sur la nature du sol et de la forêt qui les bordent, et sur l'étymologie de la plupart des noms sauvages que portent ces cours d'eau.

Ce Dictionnaire sera probablement suivi d'une autre étude sur les baies et les îles dans la même Province.

Pour encourager davantage le goût des études géographiques, la Société de Géographie de Québec a décidé, au commencement de 1914, de distribuer une série de prix aux institutions qui sont affiliées à la Société, et dont le programme d'études comporte l'enseignement géographique. Ces prix que nous devons à la générosité de quelques-uns de nos membres, seront distribués dans le cours de juillet prochain.

On me permettra d'ajouter que la Société de Géographie de Québec suit avec beaucoup d'intérêt les cartes géographiques publiées de temps à autre, par les différents Gouvernements du Canada et qu'elle a eu même l'occasion de protester, en ces derniers temps, contre la publication de l'une de ces cartes qui laissait fort à désirer, tant sous le rapport de la traduction que sous celui de la fidélité de l'expression géographique française. La Société a exprimé en même temps l'espoir—ce à quoi l'on a acquiescé—que toutes les cartes françaises lui seraient communiquées pour révision finale, avant d'être lancées dans la circulation.

XI.—Rapport de la Société d'Archéologie et de Numismatique de Montréal.

Présenté par M. Victor Morin, LL.D., Délégué.

La Société d'Archéologie et de Numismatique de Montréal s'estime heureuse de prendre part à ces fêtes annuelles de la pensée qui se tiennent sous les auspices de la Société Royale du Canada.

Dans la modeste sphère où elle évolue, elle s'efforce d'apporter son concours à l'édification de ce "monument plus durable que l'airain" qui redira à nos descendants les gloires des héros d'autrefois, aussi bien que les œuvres des hommes du jour.

Elle s'attache surtout à tirer de l'oubli les faits et gestes des fondateurs de notre Colonie et des grands hommes de la patrie, et si nos recherches archéologiques ont parfois profané le repos des ancêtres qui dorment depuis trois siècles, leurs mânes ne nous garderont pas rigueur, j'en suis sûr, d'avoir secoué la poussière qui obscurcissait les rayons de leur gloire.

C'est dans cet esprit que nous prenions part en Octobre dernier à la célébration du centenaire de la bataille de Châteauguay en l'honneur du brave De Salaberry.

La numismatique prête un heureux concours à l'archéologie dans nos études historiques, et souvent, la découverte d'une pièce inconnue a remis au point des erreurs en voie de s'accréditer.

Notre Revue.

Nos travaux les plus intéressants sont publiés dans la Revue trimestrielle "*The Canadian Antiquarian & Numismatic Journal*," fondée en 1872, et dont la vitalité a survécu à six éclipses de durée plus ou moins longue, en 1883, 1886, 1890, 1894, 1897 et 1902. Notre dernier numéro, publié en avril, porte le No. 2 du volume XI de la Troisième Série.

Il ne m'appartient pas d'exalter les mérites de cette publication, mais je puis dire, sans fausse modestie, que les érudits qui la lisent et les sociétés-soeurs avec qui nous échangeons ont bien voulu, à diverses reprises, nous en dire du bien.

Notre liste d'échanges porte les adresses de 523 sociétés réparties dans divers pays comme suit: Canada, 210; Etats-Unis, 95; France, 70; Autriche-Hongrie, 60; Mexique, 25; Allemagne, 12; Belgique, 10; Suède, 8; Grande-Bretagne, 6; Norvège, 6; Russie, 4; Brésil, 4; Finlande, 4; Suisse, 4; Italie, 3; Pérou, 2; Argentine, 2; Hollande, 1.

Les principaux articles publiés au cours de l'année sont dûs à la plume des auteurs suivants:

Par E. Z. Massicotte:—"*Les Compagnons de Dollard*"—"*Une recrue de Colons pour Montréal en 1653 et une autre en 1659*"—"*Protêt des Marchands de Montréal contre une assemblée des Seigneurs tenue en cette ville le 21 Février 1766*"—"*Pierre Prud'homme, compagnon de LaSalle*"—"*Quel a été le Successeur de Maisonneuve*"—"*Le premier Instituteur laïque de Montréal.*"

Par E. T. Fletcher:—"*Reminiscences of Old Quebec.*"

Par W. D. Lighthall:—"*Synopsis of the History of the Antiquarian and Numismatic Society*"—"*An Interesting Pictorial Find.*"

Par O. M. Lapalice:—"*Une lettre de Mgr. de Laval*"—"*Les premières pages du régistre de la paroisse de Montréal*"—"*Compte rendu du premier Marguillier de l'Eglise Notre-Dame en 1657.*"

Par. R. W. McLachlan:—"*History of the Antiquarian and Numismatic Society*"—"*An unpublished Canadian Temperance Medal.*"

Par T. O'Leary:—"*Arnold at Quebec.*"

Par Victor Morin:— Des notes d'archéologie et de numismatique dans divers numéros, sous la rubrique "*Memoranda.*"

Séances.

La Société a tenu neuf séances mensuelles, dont sept à son siège social du Château de Ramezay, et deux aux résidences de ses membres; les réunions régulières sont suspendues pendant la vacance d'été.

Les études suivantes ont été lues au cours de ces réunions:

Par R. W. McLachlan:—"*A Canadian Blacksmith Token, muled with two United States Trade Tokens,*"—"*Jean Marie Arnaud, the First Canadian Medallist*"—"*The First Settlement of Brompton Township.*"

Par W. D. Lighthall:—"*Review of the Old Sites of Montreal.*"

Par P. O. Tremblay:—"*Les Décorations Papales.*"

Par E. Z. Massicotte:—"*Armorial de la Nouvelle-France.*"

Des exhibitions intéressantes d'incunables, de gravures, médailles et pièces de monnaie, curiosités indiennes et autres objets rares ont été faites à chaque séance par les membres de la Société.

Acquisitions.

Notre bibliothèque s'est enrichie, au cours de la présente année, de 162 volumes, brochures et documents, en outre des revues des sociétés sœurs.

Nous avons ajouté à la Galerie Nationale des personnages illustres, dix portraits, au nombre desquels il convient de citer ceux de la famille de Lord Grey, ancien Gouverneur Général du Canada, et de l'abbé H. A. Verreau, Principal de l'Ecole Normale Jacques-Cartier de 1857 à 1901.

Je dois aussi faire mention spéciale de la peinture originale dont quelques collectionneurs s'estiment heureux de posséder une chromolithographie, et qui représente la réception de Robert Symes comme Chef honoraire de la Tribu des Hurons de Lorette.

Plusieurs objets intéressants sont en outre venus s'ajouter aux richesses de notre musée; entre autres, une "armoire de sacristie," sculptée et décorée en noir et or, travail d'un ouvrier français, à Québec, en 1765.

Officiers.

Le Conseil de la Société pour l'année courante se compose des officiers suivants, dont les fonctions sont toutes honorifiques:

Président:—W. D. Lighthall, C.R., M.S.R.C.

Vice-Présidents:—James Reid, Ludger Gravel, S. M. Baylis, l'abbé N. Dubois, C. A. de Lotbinière Harwood, C.R., et Victor Morin, L.L.D.

Trésorier:—George Durnford.

Secrétaire-correspondant:—Pemberton Smith.

Secrétaire-archiviste:—R. W. McLachlan, M.S.R.C.

Conservateur du Musée:—P. O. Tremblay.

Conservateur de la Bibliothèque:—E. Z. Massicotte.

Membres du Conseil:—G. N. Moncel, J. C. A. Heriot, A. Chaussé, S. W. Ewing, O. M. H. Lapalice, R. W. Reford, F. Villeneuve, J. T. L. Ployart et l'abbé A. Couillard-Després.

Congrès des Sociétés Historiques.

Pour terminer cet exposé des travaux de la Société d'Archéologie et de Numismatique de Montréal, je suis heureux de dire qu'elle a cru devoir profiter de cette réunion de la Société Royale du Canada à Montréal, pour inviter les diverses sociétés historiques de cette Province à se réunir en congrès dans le but de traiter des questions qui les intéressent et de considérer le projet de se former en fédération.

Plusieurs d'entre elles ont signifié leur approbation et nommé leurs délégués; la réunion se tiendra au Château de Ramezay le mercredi, 27 mai courant, après la réception qui suivra la séance de la Société Royale à l'Université Laval, et j'invite cordialement, au nom de la Société que je représente, tous les membres de la Société Royale du Canada à nous honorer de leur visite au Château de Ramezay à cette occasion.

XII.—Report of the Natural History Society of Montreal.

Presented by Rev. Robert Campbell, Delegate.

The Natural History Society of Montreal begs to submit its Annual Report for the year ending May 31st, 1914, being the eighty-seventh annual report of the Society.

We join heartily in the welcome extended to the Royal Society by the citizens' committee on this the second visit with which the Royal Society has honoured our City, and gratefully recall the fact that it was on the invitation of our Society that the meeting of the Royal Society took place in Montreal in 1891.

We join the Royal Society in the expression of loss and regret upon the death of His Grace the Duke of Argyll, the Founder of the Royal Society, who, during the period of his vice-royalty, was the patron of our Society.

In common with numerous institutions, in Canada and elsewhere, the Natural History Society of Montreal mourns the loss of the Right Honourable Lord Strathcona and Mount Royal, our Honorary President for eighteen years, who, during his residence in this city, took an active share in the deliberations and operations of our Society.

It is a matter of regret to the Natural History Society that it is not in possession of premises enabling it to extend hospitality to

the Royal Society as it did on the occasion of the previous visit of your Society. During the past year a good deal of discussion took place, on the question of the erection of new buildings adequate to the needs of the Natural History Society. Preliminary conferences were also entered into with the Mechanics' Institute of Montreal and the Fraser Institute of Montreal, looking to the amalgamation of the three Societies, but so far no understanding between them has been arrived at. In any event the financial situation of the Natural History Society is more satisfactory than it has been owing to the great appreciation of the value of its real estate, and the hope is entertained that with the passing of the present financial stringency the Society will be able to proceed either alone or in conjunction with other institutions, to erect premises worthy of the Society's history and prestige, such as will fit it for carrying on its work efficiently.

For it continues to be matter of concern to the Natural History Society that for several years its members have been deprived of the use of its library and museum, owing to the lack of suitable premises in which to house them. The Society looked always to its museum as a means of educating the community in the facts of Natural History, as many of the schools of the city were in the habit of visiting it regularly and for this reason the earliest opportunity will be taken for securing an erection which will admit of the Museum being displayed to advantage.

Otherwise the Natural History Society has had a prosperous session, as the following details of its work show:—

The Officers for the Session 1913-1914 were:—

Patron—His Royal Highness Duke of Connaught, K.G., The Governor-General of Canada.

Hon. President—Lord Strathcona and Mount Royal.

President—Milton L. Hersey, M.Sc., LL.D.

Vice-Presidents—Frank D. Adams, Ph.D., F.R.S.; Dr. Howard T. Barnes, F.R.S.; J. S. Buchan, K.C., B.C.L.; Rev. Robt. Campbell, M.A., D.D.; Miss Carrie M. Derick, M.A.; J. C. Holden, F.R.G.S.; Jas. W. Pyke, Major G. W. Stephens, Miss Van Horne.

Secretary—Alfred Griffin.

Hon. Corresponding Secretary—F. W. Richards.

Hon. Treasurer—W. A. Stephenson.

Hon. Librarian—Harry Bragg, M.J.I.

Hon. Curator—Prof. Nevil Norton Evans.

Members of Council—J. A. U. Beaudry, C.E., Chairman; Prof. Jos. Bemrose, Guy M. Drummond, W. Drysdale, S. W. Ewing, Joseph Fortier, John Harper, W. D'Oyley Hutchins, H. Lampard, C. S. J. Phillips.

Superintendent—Alfred Griffin.

The communications made to the monthly meetings of the Society were as follows:—

October 27th, 1913—1. "Savages and Civilization," by Mr. James G. Ross.
2. "Notes on a Peculiar Occurrence of Coal," by Mr. J. S. Buchan, K.C., B.C.L.

November 24th, 1913— 1. "A Scientific Expedition to Tropical Africa", by Dr. F. Slater Jackson.
2. "Exhibit of Italian Coast Plants, collected in September, 1913," by Rev. Robert Campbell, M.A., D.D.

January 26th, 1914—"Zoology of the Amazon Valley," by Dr. F. Slater Jackson.

February 23rd, 1914—"Bird Songs," by Miss Louise Murphy.

March 30th, 1914—"Origin of Mount Royal—A Geological and Biological Study," by Mr. Henry Lamfard.

April 27th, 1914—"How Science aids Agriculture," by Mr. J. S. Buchan, K. C., B.C.L.

The Somerville Course of Free Lectures for the advantage of the public of Montreal covered a wide range of subjects during the past session. As on many previous occasions, the Society was under a deep debt of gratitude to members of the staff of McGill University for placing their expert knowledge at the disposal of the Lecture Committee.

The following was the programme of subjects and lectures:—

Thursday, February 12th, at 8 p.m.—Fog Signals, by Prof. L. V. King, B.A. (Assistant Professor of Physics, McGill University).

(By the courtesy of McGill University, this lecture and the following one were delivered in the Physics Building).

Thursday, February 19th, at 8 p.m.—Precious Stones, by Prof. R. P. D. Graham, B.A., M.Sc.

Thursday, February 28th, at 8 p.m.—The Fall of the Leaf, by Prof. Lloyd, M.A. (Professor of Botany, McGill University).

Thursday, March 5th, at 8 p.m.—Heredity and Sex, by Prof. Carrie M. Derick, M.A. (of the Botanical Laboratory, McGill University).

Thursday, March 12th, at 8 p.m.—Insect Pests of the Orchard, by Prof. William Lochhead, M.A., M.Sc. (of Macdonald College).

Thursday, March 19th, at 8 p.m.—The City Milk Supply, by Principal Harrison, D.Sc., F.R.S.C. (of Macdonald College).

Thursday, March 26th, at 8 p.m.—Instincts of Lower Animals,

by Prof. Arthur Willey, D.Sc., F.R.S.C. (Professor of Animal Biology, McGill University).

The Saturday half hour talks to children discussed different parts of the human body and proved most interesting to the young and were well calculated to aid in the good work of training the rising generation in correct hygenic principles. The Society was beholden to members of the medical fraternity of the city for the assistance which they cheerfully gave in spreading information among the children as to the structure of important parts of their frames and how to care for them.

The Lectures and Lecturers were as follows:—

Saturday, February 14th, 3 p.m.—The Eye, by Dr. J. A. MacMillan.

Saturday, February 21st, 3 p.m.—The Ear and Throat, by Dr. H. S. Muckleston.

Saturday, February 28th, 3 p.m.—The Teeth, by A. M. Strang, Dental Surgeon.

Saturday, March 7th, 3 p.m.—The Skin, by Dr. A. O. Freedman.

Saturday, March 14th, 3 p.m.—The Lungs, by Dr. E. S. Harding.

Saturday, March 21st, 3 p.m.—The Stomach, by Dr. F. A. C. Scrimger.

Saturday, March 28th, 3 p.m.—The Blood, by Dr. A. G. Nichols.

The Society has resumed one of its activities which has for several years been in abeyance, namely, the publication of the "Record of Science." The withdrawal of the grant formerly given by the Government to the Society so crippled its resources that it was resolved to suspend publication until such time as the grant would be continued. But hitherto it has not been possible to secure the grant and the Society has felt that an important part of its work was left undone, so long as the valuable original communications made to it were withheld from the public and resolved to resume the publications, trusting somehow to be able to meet the cost.

The Society held its annual outing in June, 1913, at Rigaud, a place of vast interest especially to Geologists; and the day was thoroughly enjoyed by the guests of the Society.

Mr. Alfred Griffin, the obliging and active Superintendent, continues to give the Society the benefit of his efficient services.

Respectfully submitted,

(Signed) Robert Campbell.

XIII.—Report of the Literary and Historical Society of Quebec.

Presented by Dr. J. M. Harper, M.A., Ph.D., F.E.I.S., Delegate.

This is the third occasion on which I have the honour to represent the Literary and Historical Society of Quebec at the meetings of the Royal Society of Canada, as one of the Associated Societies. I am glad to report that there has been no falling off in the membership of the Quebec Society, while its finances show a handsome balance, even in presence of the increased outlay for new books and the printing of sundry important documents. Two of these documents, beyond the publishing of the usual Annual Transactions, include a selection from Chevalier de Johnstone's Journals that have reference to Canada, and as written in the original French of that writer; and the Journal of Lady Durham, wife of the first Earl of Durham, Governor-General of Canada in 1837. These two documents will together form the Ninth Volume of what goes by the name of the Historical Documents in the archives of the Society, the latter embodying an account of Lady Durham's experiences in Canada during her sojourn at Quebec, as the constant companion of her distinguished, though somewhat misunderstood, husband, while the administration of Canadian public affairs was in his hands. As we all know, she was the daughter of the second Earl Grey, who held the reins of power in Great Britain, as Prime Minister from 1830 to 1833. And her journal reveals many interesting incidents in connection with the political incongruities of rule that her husband had to face and try to correct, during his short but momentous residence in Quebec—with many other references to the social conditions of these early times and local alliances for and against progressive government.

Two other documents or manuscripts, namely, the Diary of Lieutenant Charles Grey and the Letters of Mrs. Alicia Cockburn, are in process of being printed, and will form the Tenth Volume of our Historical Documents, to be added during the current year. Lieutenant Grey was an officer in the Guards which had been sent out to undertake the defence of Canada, he being a brother of Lady Durham, and becoming later an equerry to the young Queen Victoria and still later her private secretary, ending his public career as General Sir Charles Grey. He was the father of Canada's recent Governor-General, the fourth Earl Grey. His diary now in the hands of the Quebec Society refers to personal experiences during his journeyings from Kingston to Ottawa and Montreal and his personal knowledge of the condition of affairs along the American frontier in 1837. On the other hand, Mrs. Cockburn's Letters refer to her personal knowledge

of the conditions in Canada during the War of 1812. She was the wife of a British officer who was called upon to share in the movements of his regiment along the frontier during that troublous period. The letters refer in a special way to the mixed public opinion concerning Sir George Prevost's manner of campaigning to the disadvantage of the country.

At the annual meeting of the Society held in January last, the Hon. Justice McCorkill was chosen President, with little or no other change in the membership of the Council. During the winter the Rev. Father O'Leary delivered two illustrated lectures on the topography of Quebec, as embodied in his re-modelling of the plan of the town as it was laid out in 1800—the restored model being to be seen in one of the rooms of the Archives Department at Ottawa. In addition to these two highly interesting lectures with crowded audiences to listen to them, Lieut-Colonel Harston gave another illustrated lecture, on the Panama Canal and its environs.

The monthly meetings of the Society, followed always by a meeting of the Council, continue to be regularly attended, at which the routine reports of the various sub-committees are read and discussed and the donations of books for the library and historical documents and publications duly received and reported on. There have been the usual large ingathering of exchanges from the most prominent Literary Societies in the world; and under the supervision of Colonel William Wood and Mr. E. T. D. Chambers, a Handlist of all the additions to the library has been issued in neat form.

The list of Societies with which the Quebec Society is affiliated include The Royal United Service Institute, London; The Royal Engineer's Institute, Chatham; The Smithsonian Institution, Washington; The Royal Irish Academy; The Royal Society of Canada; The Royal Society of Edinburgh; The Royal Society of Dublin; The Royal Society of New South Wales; The Royal Society of Queensland; The Royal Geographical Society of Australia; The Commission of Conservation of Canada, and many others.

Altogether the oldest Literary and Historical Society of Canada continues to hold its own, the number of those taking advantage of its large and growing library showing a commendable increase. And in its prosperity it sends greeting to the prosperous Royal Society of Canada.

The following is a list of its Officers and Members of Council for 1914.

Officers and Council for 1914.

Hon. President—James Douglas, D.C.L.

President—Mr. Justice McCorkill.

Vice-Presidents—J. T. Ross, A. H. Cook, Col. Turnbull, Dr. J. M. Harper.

Treasurer—James Geggie.

Recording Secretary—A. Robertson.

Corresponding Secretary—Lieut.-Col. Lindsay.

Council Secretary—Wm. Clint.

Librarian—E. T. D. Chambers.

Curator of Museum—Philias Gagnon.

Curator of Apparatus—J. M. Johnston.

Additional Members of Council—Rev. Dr. Scott, Rev. Father O'Leary, F. Lampson, D. H. Geggie.

Past Presidents ex-officio—Lt.-Col. Wood, P. B. Casgrain, Cy. Tessier, Dr. G. W. Parmelee, Dr. John Hamilton, Col. H. Neilson.

The President ex-officio member of all Committees.

XIV.—Report of the Nova Scotia Historical Society.

Presented by Hon. Mr. JUSTICE LONGLEY, F.R.S.C., Delegate.

Officers of the N.S. Historical Society, elected 3rd April, 1914.

President—Ven. Archdeacon Armitage, Ph.D.

Vice-Presidents—Dr. David Allison, Major J. Plimsoll Edwards and Joseph A. Chisholm, K.C.

Corresponding Secretary—Harry Piers.

Recording Secretary—William L. Payzant.

Treasurer—George E. E. Nichols.

Auditors—W. L. Brown and Lt.-Col. F. H. Oxley.

Other Members of Council—Dr. A. H. Mackay, G. W. T. Irving, W. C. Milner and George Mullane.

Library Commissioners—James S. Macdonald, Rev. Dr. John Forrest, Dr. A. H. MacKay and Dr. J. Johnston Hunt.

The membership was increased during the year 1913-14 by the election of 164 new members.

The following historic Tablets have been erected:—

1. To mark the Birth-place of Sir John Inglis, The Hero of Lucknow (Unveiled by Colonel the Hon. Sam. Hughes).

2. To mark the "Gun" used on the "Shannon," in the famous action with the Chesapeake; and long used as the Noon-day gun of Halifax. (Unveiled by Sir Ian Hamilton).

3. The Birth-place of Sir Provo Wallis. (Unveiled by Captain Martin).

4. The Birth-place of Major General John Charles Beckwith. (Unveiled by Colonel Rutherford.)

5. To Commemorate Colonel Joseph Frederick Wallet Des Barres. (Unveiled by Mr. Jas. S. Macdonald).

6. To mark the Birth-place of Admiral Philipps Cosby, (1727-1808); Admiral William Wolseley, (1756-42).

LIST OF N.S. HISTORICAL SOCIETY PAPERS READ DURING THE YEAR 1913-14.

April	1913—	"Reminiscences of the House of the Assembly," read by Justice Russell.
May	"	"Reminiscences of a Long Life by John McKay, New Glasgow, 1792-1884," read by Rev. Dr. Pollock.
Nov.	1914—	"Bishop Charles Inglis, the 1st Bishop of Nova Scotia," read by the President.
Dec.	"	"History of Guysboro and the Hallowell Grant," by Dr. A. C. Jost, read by Mr. Macdonald in the absence of Dr. Jost.
Jan.	"	"A Brief History of the Town of Bridgetown," together with a short sketch of the late Colonel Poyntz, read by John Irwin, K.C., of Bridgetown.
Feb.	"	"Wolfe's Men and Nova Scotia," read by Beckles Willson, of Clifton Grove, Windsor.
Mar.	"	"Chief Justice Jonathan Belcher, first Chief Justice of Nova Scotia," read by Sir Charles Townsend, Chief Justice of the Supreme Court.
April	"	"Lord Halifax," read by A. Martin Payne.
May	"	"Artists in Nova Scotia," read by Harry Piers, curator of Provincial Museum of N.S.

XV.—Report of the Nova Scotia Institute of Science, Halifax. Established 31st December, 1862.

Presented by A. H. MACKAY, LL.D., F.R.S.C., Delegate.

The Nova Scotia Institute of Science begs to present the following report on its proceedings during its fifty-first annual session (1913-14).

The following officers were elected for the year 1913-14:

President—Donald MacEachearn Ferguson, F.C.S., *ex-officio* F.R.M.S.

First Vice-President—President Arthur Stanley MacKenzie, Ph.D., F.R.S.C.

Second Vice-President—Alexander Howard MacKay, LL.D., F.R.S.C.

Treasurer—Maynard Bowman, B.A.

Corresponding Secretary—Prof. Ebenezer MacKay, Ph.D.

Recording Secretary and Librarian—Harry Piers.

Councillors without office—Prof. Clarence L. Moore, M.A., F.R.S.C.; Alexander McKay, M.A.; Prof. David Fraser Harris, M.D., C.N., D.Sc., F.R.S.E.; Donald Sutherland McIntosh, B.A., M.Sc.; Carleton Bell Nickerson, M.A.; Prof. Howard Logan Bronson, Ph.D.; and William Harrop Hattie, M.D.

Auditors—Watson Lindley Bishop and William McKerron.

Meetings were held from 8th October, 1913, to 18th May, 1914, at which the following papers were presented:—

1. "Presidential Address: (a) deceased members, (b) problems in biochemistry," by Donald M. Ferguson, F.C.S.

2. "On the existence of a Reducing Endo-enzyme in Animal Tissues," by Prof. D. Fraser Harris, M.D., C.M., D.Sc., F.R.S.E.

3. "*Senecio jacobaea* and its parasite *Callimorpha jacobaea:* the Ragwort and the Cinnabar Moth," by Henry S. Poole, D.Sc., F.R.S.C. With additional notes on the subject, by A. H. MacKay, LL.D., F.R.S.C.

4. "Notes on the Analysis of 'Ironstone' from the King's Quarry, North West Arm, Halifax," by H. B. Vickery.

5. "The Geology of a Portion of Shelburne County, South Western Nova Scotia," by Sidney Powers.

6. "Additional notes on 'Integral Atomic Weights,' " by Frank W. Dodd, C.E.

7. "On the Electrical Properties of Acetic Acid in the Solid and Liquid Phases," by John H. L. Johnstone, B.Sc.

8. "Coloured Thinking," by Prof. D. Fraser Harris, M.D., D.Sc., F.R.S.E.

9. "Analyses of Nova Scotian Soils," by Prof. L. C. Harlow, B.Sc.

10. "Phenological Observations in Nova Scotia, 1913," by A. H. MacKay, LL.D., F.R.S.C.

During the year 1913, the Library and Institute received 1,766 books and pamphlets. The total number received in the same year by the Provincial Science Library, with which that of the Society is incorporated, was 2,928. The total number of books and pamphlets in the Science Library on 31st December, 1913, was 51,810, of which 37,614 (or 72 per cent) belong to the Institute.

The Proceedings and Transactions, vol. XII, part 4, the publication of which had been delayed, have been issued; and vol. XIII, part 3 is in the press.

XVI.—Report of the New Brunswick Historical Society.

Presented by VEN. ARCHDEACON RAYMOND, F.R.S.C., Delegate.

This Society has to deplore the loss, during the course of a single year, of three of its most active and esteemed members, namely, Dr. George U. Hay, David Russell Jack and Jonas Howe. At the time of his death Dr. Hay was president of the Society, Mr. Jack its active and energetic corresponding secretary, and Mr. Howe, librarian. Each of these gentlemen had, from time to time, contributed valuable papers to the Society, and the removal of these gentlemen has deprived us of three of our none too numerous band of serious workers.

The Society has now entered upon the fortieth year of its existence, having been incorporated on the 9th of September, 1874.

During the past year the Society has taken a leading part in the movement to preserve and beautify the site of Fort Howe, which lies within the bounds of the City of St. John. This matter has now been taken in hand by the Dominion Parks Branch of the Department of the Interior at Ottawa, and plans are being prepared to make the fort site a national and historical park. The Society will co-operate with the department at Ottawa in suggestions as to the way in which the park may be most effectively laid out. The desire of the Society is to preserve and enhance the old-time character of Fort Howe as a stronghold dominating the city. The predominant idea will be one of rugged picturesqueness. The incidents associated with Madame La Tour, Major Studholme, William Cobbet, the advent of the Loyalists and the old garrison days must each and all have at Fort Howe park their fitting memorial. A principal feature of the schene will be an ample terrace overlooking the harbour, the view from which will be of surpassing interest to every visitor.

The Historical Society has now in press another volume of its collections. The papers selected for publication include several of great interest to New Brunswick people: one on the Miramichi settlement in Eastern New Brunswick, founded by William Davidson, in 1765, contributed by Professor W. F. Ganong, of Smith College, Northampton, Massachusetts, our active corresponding member. To Senator Patrick Therriault, of the adjoining State of Maine, the

Society is indebted for a valuable report made by Messrs. Deane and Kavanagh upon the settlements existing in 1831 upon the valley of the Upper St. John and its tributaries. This paper with an introduction by Archdeacon Raymond and annotations by Placide P. Gaudet, the learned Acadian genealogist, is important for its detailed account of the Madawaska and Aroostook region at the time of the international boundary dispute.

A third paper has been contributed by Professor W. H. Siebert, of the University of Ohio, on the Loyalists of Penobscot and their Settlement at Passamaquoddy in the County of Charlotte, N.B. To this there is added an interesting appendix by the Secretary of the Historical Society. A copy of the collections will be sent to the Royal Society in due course.

XVII.—The New Brunswick Loyalists' Society.

Presented by Ven. Archdeacon Raymond, F.R.S.C., Delegate.

Since the last report of this Society was presented, meetings have been regularly held with a good attendance, and a growing interest of the members has been displayed in the objects the Society is designed to promote.

A special effort has been made to arouse public interest in the preservation of the spot where lie the ashes of the founders of St. John. For many years their resting place, in the very heart of the city, has been neglected and has been to some extent a place of resort for loiterers and persons of ill repute. The city authorities led by our energetic and capable mayor, who is himself of Loyalist descent, have now determined to take immediate steps for the protection and beautifying of the spot. The Loyalists' Society is to be congratulated upon the result of its persistent efforts.

The annual commemoration of the Landing of the Loyalists on the 18th of May was observed by the general flying of flags throughout the city, the firing of salutes and the proclaiming of a holiday in the public schools, as in former years. The anniversary service in Trinity Church was unusually impressive. Seats were reserved for the Lieutenant Governor of the Province, the Mayor of the City, and members of the Loyalists' Society, and a sermon appropriate to the occasion preached by the Chaplain. The spacious edifice was crowded to the doors. The meeting on the following evening, the 18th of May, at the Assembly Rooms of the York theatre, was a brilliant close to the commemoration. The rooms were beautifully decorated by Loyalist Chapter of the Daughters of the Empire. The president of the Society, D. J. Seely,

was in the chair and the occasion was honoured by the presence of the Lieutenant Governor, the Mayor of the City, presidents of the various patriotic and national societies, members of the Canadain Club, Women's Canadian Club, Daughters of the Empire and the New Brunswick Historical Society. The speaker of the evening was Mr. James H. Stark of Boston, the well-known author of "The Loyalists of Massachusetts." Mr. Stark discussed the question "Was the American Revolution justifiable?" As might be expected by those who have read his remarkable work on "The Loyalists of Massachusetts," Mr. Stark made a strong argument to prove that the grievances of the Colonies in 1776 were greatly exaggerated, that the active promoters of the revolution had selfish ends to serve, and that the reforms which were sought might have been attained without the necessity of the dismemberment of the Empire.

A resolution, moved by Archdeacon Raymond and seconded by ex-Mayor Sears, was adopted with enthusiasm by the meeting. The resolution is as follows:

"*Resolved*, That this meeting of members of the Loyalists' Society of New Brunswick, New Brunswick Historical Society, Canadian Club, Women's Canadian Club, Daughters of the Empire (Chapters Loyalist, Brunswick and De Monts) and representative citizens assembled to commemorate the 131st anniversary of the landing of Loyalists on the 18th of May, 1783, heartily concur in the suggestion that has emanated from the sister United Empire Loyalists' Association of Ontario, that steps be taken at an early date to place in Westminster Abbey, with the permission of the governing authorities, a suitable memorial to those Loyalists who sacrificed so much at what they felt to be the call of duty, and afterwards played so important a part in the upbuilding of the Canadian Dominion. We to-day recall their fidelity to the cause of an united British Empire, their devotion to principle in defiance of loss and pain, their courage, their perseverance and their clear prevision of the importance of race unity, and feel that it deserves the highest recognition."

Our Society has met with a severe loss in the sudden removal by death of D. Russell Jack, its historian and most active member. One of our number has rendered fitting tribute to him in these words:—

Our careful comrade bending studious head
To trace the annals of illustrious dead,
To build a tale for those of after years,
A tale of steadfast courage, toil and tears,
Was no less brave than they!

Proc. 1914, 11.

For when the far, imperious call was heard
He calmly rose to greet the summoning word,
To bid his friends a cheerful last good-bye,
To leave unfinished task without a sigh
His mortal debt to pay.

His name shall be recorded on our roll
As one who laboured heart and mind and soul
To do his duty well!

XVIII.—Report of The Natural History Society of New Brunswick.

Presented by L. W. Bailey, F.R.S.C., Delegate

On behalf of the Council and Members of the Natural History Society of New Brunswick, I have the honour to present the following report:—

The work of the Society, during the year 1913, has been of a most satisfactory character. The membership is now 604. The City of St. John has increased its annual grant to the Society, and prominent citizens have made special contributions to the funds. Many valuable donations have been received for the Library and Museum.

For many years members of the Society have been actively engaged in original investigation and during the past year work of an original character has been vigorously carried on. Dr. Matthew has continued his studies of the Cambrian formations of Eastern Canada, and read a paper on this subject before your Society during the present session.

Dr. L. W. Bailey's studies of the Diatoms of Eastern Canada has been carried on and valuable articles from his pen on this subject have been published in recent numbers of the Bulletin of the Natural History Society of New Brunswick. Dr. W. F. Ganong has continued his Historical and Physiographic Studies of New Brunswick and in the current Bulletin of this Society publishes articles on the Natural History and Physiography of that Province.

A. Gordon Leavitt's researches in Ornithology have been continued and William McIntosh has written a short article on "The Aboriginal Chipped and Flaked Implements of New Brunswick." This with articles by other writers will be found in the last Bulletin of the Natural History Society of New Brunswick, which I present herewith.

A brief summary of the more important work accomplished by the Society during the past year is as follows:—

Investigation of Prehistoric Indian Camp Sites.

239 Stone Age implements and many hundreds of pottery fragments collected.

1740 Specimens named for teachers and others.

Collections loaned schools accompanied by lessons.

Nature talks by the Curator in the Public Schools.

Special lectures in the Museum to Public School classes and young people's clubs.

Considerable additions have been made to the following collections: Birds, insects, galls, rare New Brunswick plants, lichens, minerals and fossils.

During the year the members of the Society were called upon to mourn the loss of its President, Hon. John V. Ellis, LL.D., its 2d Vice-President, George U. Hay, D. Sc., F.R.S.C. and Henry George Addy, Esq., M.D., a member of its council.

Officers of the Natural History Society of New Brunswick, 1913-14:—

President—W. F. Burditt.

Vice-Presidents—James A. Estey, R. B. Emerson.

Treasurer—A. Gordon Leavitt.

Curator and Corresponding Secretary—Wm. McIntosh.

Recording Secretary—W. L. McDiarmid.

Librarian—Joshua Clawson.

Additional Members of Council—Dr. G. F. Matthew, J. Roy Campbell, T. H. Estabrooks.

Executive oe Ladies' Association

President—Mrs. Geo. F. Matthew.

Vice-Presidents—Mrs. J. V. Ellis, Mrs. John A. McAvity, Mrs. John R. McIntosh, Mrs. J. H. Frink.

Treasurer—Miss Grace W. Leavitt.

Recording Secretary—Mrs. F. B. Cowgill.

Corresponding Secretary—Miss Edith M. Kee.

The following Regular Meetings were held during the year:—

1912

Oct. 1—Results of Summer Outings, G. F. Matthew, LL.D.

Oct. 15—Annual Meeting. Presentation of Yearly Report.

Nov. 5—Foraminifera, Radiolaria and Sponges (with illustrations), L. W. Bailey, LL.D.

Nov. 12—Celebration of Fiftieth Anniversary.
Dec. 3—Insect Parasitism—In Special Relation to the Control of the Browntail Moth—John D. Tothill (in charge of Dominion Experiment Station, Fredericton).
1913—Fifty Years Progress in:—
Jan. 7—Geology—G. F. Matthew, LL.D.
Feb. 4—Botany—G. U. Hay, D.Sc.
Mar. 4—Archaeology—Wm. McIntosh.
April 1—Ornithology—A. Gordon Leavitt.
May 6—Medicine—T. D. Walker, M.D.
June 3—Physiography of New Brunswick—W. F. Ganong, Ph.D.

A course of popular lectures was given during the winter, on Tuesday evenings, not occupied by the regular meetings of the Society; these were free to the public.

Jan. 14—The Buried Cities of Sicily—Rev. R. A. Armstrong.
Jan. 21—The Story of Lumbering on the St. John River; Its Past, Present and Future—J. Fraser Gregory, Esq.
Jan. 28—Natural Gas; Its Development and Possibilities—J.A.S. Henderson, Esq.
Feb. 11—The Iron Industry—Charles McDonald, Esq.
Feb. 18—Aerial Navigation and Its Possibilities—W. R. Turnbull, Esq.
Feb. 25—Pulp and Paper—Senator N. M. Jones.
Mar. 11—Nature and Art in the Modern City—W. F. Burditt, Esq.
Mar. 18—The Water Supply of St. John—Wm. Murdock, Esq., C.E.
Mar. 25—Electricity: The Incandescent Lamp—Professor Claude S. McGinnis.
April 8—The Food Fishes of New Brunswick—Wm. M. McLean, Esq.

The following Lectures were delivered before the Ladies Association of the Natural History Society. Thursday afternoons:—

Oct. 30—Egypt—Miss E. R. Scovil.
Nov. 6—Buddha—Mrs. E. S. Fiske.
Nov. 13—The Dinosaurs—Mrs. G. F. Matthew.
Nov. 20—The Pueblo Indians—Mrs. A. M. Sayre.
Nov. 27—Prehistoric Acadia: Social Life—Talk by Wm. McIntosh. (Tableau and Living Pictures by Junior Members).
Dec. 4—Prehistoric Acadia: Arts and Industries—Talk by Wm. McIntosh. (Tableau and Living Pictures by Junior Members).

Jan. 15—Domestic Science in Relation to the Home—Mrs. E. K. Milligan.
Jan. 22—Domestic Science in Relation to the School Curriculum—Miss Katherine R. Bartlett.
Jan. 29—Dietetics—Miss Jessie Church.
Feb. 3—Social and Ethical Efficiency, in its Effect on the Individual—Miss Jean B. Peacock.
Feb. 12——Social and Ethical Efficiency, in its Effect on Society—Mrs. John A. McAvity.
Feb. 19—Sanitation and Economy, in Regard to Individual and Public Health—Dr. Geo. G. Melvin.
Feb. 26—Our Housing Problem—W. F. Burditt, Esq.

XIX.—Report of The Elgin Historical and Scientific Institute.

Presented by Dr. J. H. Coyne, F.R.S.C., Delegate.

The Elgin Historical and Scientific Institute has the pleasure of reporting another successful year.

Eight meetings have been held, at which papers were read or addresses delivered as follows:—

"Report on The Ontario Historical Society's Annual Meeting at Chatham, Amherstburg and Moraviantown," by Delegates Judge Ermatinger, Herbert S. Wegg and Dr. James H. Coyne.

"Report on the Celebration October 16th, 1913, of the Centenary of Tecumseh's death at Moraviantown," by Judge Ermatinger and Dr. Coyne.

"A Trip to Norway," by Dr. Archibald Leitch.

"The late King Edward's Visit to South Western Ontario in 1860," by Judge Ermatinger.

"A Roman Lawyer, Statesman and Letter-writer of the time of the Emperor Trajan," being an account of the life and work of Pliny the Younger, by Dr. James H. Coyne.

"The Niagara District and International Relations," by Hon. Peter Porter of Niagara Falls, N.Y.

"Pioneer Experiences in South Dorchester," from reminiscences of Matthew Whyte, by James E. Orr.

"Recollections of Mission Life in Muskoka," by Rev. N. H. McGillivray.

"The Discovery and Exploration of Lake Erie," illustrated by numerous ancient French maps and some photographs, by the President.

"Canadian Literature," by Miss Ella N. Bowes, B.A.

An interesting innovation was the holding of one of the regular meetings of the Institute in the Township of Westminster at the residence of Mr. James E. Orr.

The proposed celebration of the Centenary of Peace has been warmly approved by the Institute, and a Committee appointed to co-operate with the Canadian Branch of the International Committee and local organizations in carrying it into effect.

The Institute is indebted to a number of Societies and Institutions for copies of their Transactions and other publications and to several individual donors for gifts to the Library and Museum.

The programme outlined for the Session of 1914-1915 will have special reference to the Centenary of Peace.

Six new members were elected during the year.

The officers for the year 1914-1915 are as follows:—

President—James H. Coyne, LL.D., F.R.S.C.

Vice-President—Mrs. J. H. Wilson.

Secretary—W. W. Olmstead.

Treasurer—W. H. Murch.

Editor—Judge C. O. Ermatinger.

Curator—Dr. Archibald Leitch.

Councillors—K. W. McKay, J. W. Stewart, A. W. Graham, Dr. Charles W. Marlatt, Mrs. J. S. Robertson.

Advisory Council—John F. Langan, F.R.G.S.; Rev. Principal Warner, M.A., D.D.; H. S. Wegg, Mrs. Symington, C. St. Clair Leitch, Mrs. W. St. Thomas Smith, F. B. Holtby, Mrs. Archibald Leitch, Miss Ella N. Bowes, B.A.

The Treasurer's Report shows a balance on hand of $322.28.

XX.—Report of The Women's Historical Society of St. Thomas.

Presented by MARGARET A. COYNE, B.A., Delegate.

The Women's Historical Society of St. Thomas reports as follows:—

Six regular meetings of the Society were held during the year besides several meetings of the Executive and other Committees.

These were in addition to the eight meetings of The Elgin Historical and Scientific Institute, of which The Women's Historical Society is an auxiliary, its members being also members of the Institute.

The membership list is limited to one hundred, vacancies as they occur being filled by election from a considerable waiting list.

The programme for the year included the Confederation movement with sketches of the life and work of prominent statesmen of the period. The list was as follows:—

"The Eve of Confederation, " by Mrs. J. H. Wilson.
"George Brown," by Mrs. J. D. Curtis.
"The British North America Act," by Mrs. C. W. Colter.
"Sir John McDonald and Sir Charles Tupper," by Mrs. F. B. Holtby.
"Sir George Etienne Cartier," by Miss Ella N. Bowes, B.A.
"The Davis Farm, St. Thomas," by Mrs. George A. Anderson.
"William Macdougall," by Mrs. J. S. Robertson.
"Thomas D'Arcy McGee," by Mrs. J. M. McIntyre.
"Joseph Howe," by Miss Margaret Cook, B.A.
"Sir Alexander Galt," by Mrs. H. P. Westgate.
"Sir Alexander Campbell," by Mrs. H. Lindop.
"Sir Leonard Tilley," by Mrs. W. H. Murch.
"Mr. Symington, Sr.," by Mrs. Fessant.
"John Hamilton Gray of Prince Edward Island," by Miss M. Farley.
"Sir Oliver Mowat," by Mrs. B. Marlatt.

The finances are in a satisfactory condition with a cash balance of $552.78 at the end of the year.

The Society's Officers for the year 1913-1914 are as follows:—

President—Mrs. J. H. Wilson.

Vice-Presidents—1st, Mrs. J. H. Coyne; 2nd, Mrs. J. D. Curtis; 3rd, Mrs. J. S. Roberston.

Secretary-Treasurer—Mrs. Symington.

Assistant Secretary—Mrs. F. A. Fessant.

Assistant Treasurer—Miss Florence McLachlin.

Corresponding Secretary—Mrs. J. H. Jones.

Curator—Miss M. Langan.

XXI.—Report of the Niagara Historical Society.

By Miss Janet Carnochan, President.

Our Society has this year to record that regular meetings were held during the winter months and the following papers were read: "Report of the meeting near Thamesville referring to a monument to Tecumseh," by Rev. C. K. Masters, M.A., of Thamesville. "Chivalry and War," by Rev. A. F. MacGregor, M.A. "Notes on the history of Niagara District, 1791-1793," by Col. E. A. Cruikshank, F.R.S.C. Letters were read conveying interesting information from Hon. W. R. Riddell, Hon. P. A. Porter, Dr. Mibroy, Scotland, T. K. Thomson, C.E., New York, and others.

We have published this year No. 25 consisting of "Notes on Laura Ingersoll Secord, by Mrs. E. J. Thompson, "Monument at Lundy's Lane," and "Early days of Queenston," by Miss Carnochan, "Diary of a prisoner in Fort Garry, 1869-1870," contributed by Mrs. Bottomley. We have republished our No. 5 long out of print and for which many requests have been made and we are now printing Col. Cruikshanks' paper mentioned above. Over 600 pamphlets have been distributed during the year and 400 copies of our 18th annual report. A new book case has been provided and an arm chair has been made from part of an oak beam of old Navy Hall. Two new tablets have been placed in the room and two markers for historic spots have been ordered.

Among the numerous visitors there have been several interesting groups of young students. A group of girls from the Bishop Strachan School, Toronto, over fifty of the History class of the Welland High School and a group from the "Circle of Young Canada," Toronto, also Cadets, Scouts and many military visitors and others from many lands.

The fifth annual picnic of the Society was held at Queenston Heights in August, 1913, and was numerously attended, members being present from Toronto, New York, St. Catharines, Thorold, Queenston, Beamsville and Niagara Falls, etc. A resolution was passed calling attention to the inaccuracies in the speeches reported given at Fort Erie respecting the hundred years of peace.

During the year the President as delegate attended the annual meeting of the Ontario Historical Society in September at Chatham, when a visit was paid to historic Amherstburg. Stoney Creek was also visited when the monument was unveiled.

During the year twenty members have been added and at the last annual meeting the Treasurer's Statement shewed that the receipts for Members' Fees were \$106, Govt. Grant, \$200, County grant,\$25, sale of pamphlets, \$43, Contribution box, \$26. In the expenditure printing and engraving, \$197, maps and mounting, \$45, postage, \$24, other outlay was for express, insurance, tablet work done and there was a respectable balance on hand.

Among the contributions may be mentioned: Original letter of Joseph Brant, 1799; Poster Proclamation of General Brock at York Fort, 1812; York Gazette, 24th October, with account of the funeral of General Brock; London Times,1805, with account of the battles of Trafalgar, Bird Amuelet (Indian), Buckles found here of 41st Regt. and Dr. Wattville Regt., 1813. Three coins used by Hudson Bay Co., in paying Indians, 1M.B., ½ M.B. and ¼ M.B. Tuning box used in the Methodist church in early years, picture of Battle of Ba-

toche, jewel box made from gunboat sunk in 1813, near Chatham and raised many years after, Boer flag from Belfast, South Africa, Farewell words in verse of Samuel Lount who was executed in Toronto, 1838, also many valuable books and Transactions of Historical Societies received in exchange. Many letters are received asking for information and 240 letters have been written by the President during the year in the interest of the Society.

All of which is respectfully submitted.

JANET CARNOCHAN, President.

Officers for the year 1914.

Honorary President—Col. Cruikshank, F.R.S.C.

President—Miss Carnochan.

Vice-Pres.—Rev. Canon Garrett.

2nd Vice-Pres.—Mrs. T. F. Best.

Secretary—John Eckersley.

Curator and Editor—Miss Carnochan.

Assistant Curators—Mrs. E. J. Thompson, Miss Cried.

Committee—Alfred Ball, Mrs. Goff, Miss Clement, Wm. Ryan, C. E. Sproule.

Mémoires de la Société Royale du Canada
SECTION I

Série III | JUIN 1914 | Vol. VIII

La question de la réforme orthographique.

Par Adjutor Rivard, Québec.

La question de la réforme orthographique est ancienne. Les plus violents *réformistes* de ces dernières années ne font que reprendre les doléances des Meigrettistes de la Renaissance[1]. A dire vrai, la réforme orthographique n'est autre chose que l'évolution des signes traducteurs des sons; elle commence le jour où naît le dialecte, elle le suit dans ses transformations successives, elle finit quand se fixe et meurt la langue. L'orthographe latine est immobilisée, parce que le latin, mort, ne change plus; l'orthographe française se modifie, parce que les sons du français, encore vivants, varient. *Consuetudo loquendi est in motu*, disait Varron. Le mot parlé se meut, organisme vivant; donc le mot écrit, figure de l'autre, doit évoluer aussi. S'il en avait été autrement, l'orthographe française, immobile tandis que marchait la prononciation, serait arrivée à ne représenter plus les sons actuels de la langue: nous écririons latin, cependant que nous parlerions français; par exemple, *pensum* se prononcerait *pwa* ("poids") *digitus* serait la figuration graphique de *dwa* ("doigt"), et *bonum angurium* représenterait "bonheur". Pour mieux dire, si l'orthographe ne s'était pas continuellement transformée, il n'y aurait pas de langue française; et si elle ne continuait pas à changer, nous parlerions bientôt une langue qui n'aurait pas de nom. Car l'écriture exerce sur la prononciation une influence d'autant plus grande que l'instruction est plus répandue. Par la lecture, des lettres parasites finissent par s'introduire dans la prononciation. C'est ainsi que le *p*

[1] Parmi les linguistes, les philologues, les grammairiens, les professeurs de notre époque, partisans de la réforme orthographique, les plus connus sont MM. Gréard, Gaston Paris, Lavisse, Liard, Rabier, Buisson, Bréal, Havet, Clédat, Darmesteter, Lebaigue, Renard, Dussouchet, P. Passy, Ernault, Chevaldin, Ch. Richet, Gazier, Gebhart, Petit de Julleville, Brunot, Foncin, Compayré, Ravaisson, J. Steeg, L. Zeller, Ch. Dupuy, Boutmy, Perrot, Meyer, Beljame, Cartault, Crouslé, Decharme, Larroumet, Marion, Psichari, etc.—Parmi les grammairiens et les littérateurs d'autrefois, les plus considérables furent aussi des réformateurs, parfois violents, souvent peu sûrs: Meigret (qui fit école; il y eût les *meigrettistes* et les *anti-meigrettistes*), Péletier, Ronsard, du Bellay, Baif, Ramus, Rambaud, Montaigne, Chifflet, les grammairiens de Port-Royal, ceux de Trévoux, Ménage, Buffier, du Marsais, de Wailly, Domergue, Marle, Vanier, etc.; Corneille, Bossuet, Dangeau, l'abbé Girard, l'abbé de Saint-Pierre, Duclos, Beauzée, Voltaire, Nodier, Andrieux, Littré, Sainte-Beuve, F. Didot, etc. Mais la phase active de la propagande pour la réforme date d'une quinzaine d'années; c'est aussi depuis cette époque que se sont élaborés les systèmes les plus logiques, à base scientifique.

tend à se faire entendre dans "dompteur" et dans "cheptel", le *g* dans "amygdale" et dans "legs", que *gageure* commence à se prononcer comme il est écrit, etc. "Or, dans une langue comme la nôtre, disait Littré à une époque où le mal n'était pourtant pas aussi grand qu'aujourd'hui, il ne peut rien y avoir de plus défectueux et de plus corrupteur que la tendance générale à conformer la prononciation à l'écriture."

Jadis, la langue étant surtout parlée, la prononciation évoluait indépendamment de l'écriture. Aujourd'hui, les choses sont changées, et l'écriture menace de diriger l'évolution des sons. Qu'y faire? Réformer l'orthographe, en élaguer les lettres dangereuses, les anomalies, tout ce qui présente un danger; empêcher, en un mot, l'écriture d'exercer sur le langage une influence qui ne lui appartient pas. Nécessité, donc, d'une réforme artificielle, puisque les transformations ne se font plus naturellement.

Mais il est naturel que la langue écrite, expression plus réfléchie que la parole, soit en retard. Si l'orthographe changeait en même temps et aussi librement qu'évolue la prononciation, on ne lirait qu'avec peine les auteurs qui ont écrit il y a un siècle. Et que serait-ce, avec un système d'orthographe phonétique? La lecture des livres d'aujourd'hui exigerait dans dix ans un travail de déchiffrement. Et puis, le mot écrit, avec la pureté de lignes acquise en passant par la forge populaire, n'a-t-il pas aussi sa beauté?

Les réformistes ont donc à résoudre ce problème: rapprocher l'orthographe de la prononciation, sans changer la physionomie générale de l'écriture, sans gêner le libre développement des sons, et sans violer les lois qui président à la naissance et à la vie des mots. Il s'ensuit que les projets de réforme radicale, totale et immédiate doivent être rejetés, mais aussi que toute simplification conforme au génie de la langue est légitime, si elle ne trouble pas trop brusquement ni trop profondément l'économie générale des graphies françaises, et, à meilleure raison, si, loin de créer des exceptions, de transgresser les lois connues et de défigurer le vocabulaire, elle fait disparaître des anomalies, rétablit la régularité des formes et donne aux mots une beauté qu'ils n'avaient point.

Car, il faut s'en souvenir, l'orthographe française n'est franchement ni phonétique ni étymologique; elle est traditionnelle et fondée sur l'usage.

Si l'usage est la règle, direz-vous, il s'y faut soumettre, et toute tentative de réforme artificielle est mal venue. Encore faut-il distinguer. "C'est l'usage, écrivait Castil-Blaze; mais il faudrait examiner d'abord si l'usage n'est point un imbécile."[1] Car il ne s'agit

[1] *L'art des vers lyriques*, p. 26.

pas ici de l'usage populaire, mais d'un usage arbitraire établi par les érudits des siècles derniers; en fait de langue on sait que cet usage n'est pas le plus sûr, et qu'il a besoin parfois d'être redressé. Pourquoi un *g* dans *vingt* sorti de *viginti*, dans "doigt" de *digitus*, quand ce *g* ne s'est jamais prononcé en français et qu'il n'a pas été conservé dans "trente" de *triginta*, dans "froid" de *frigidus*?....

A une époque où la science étymologique était faite de théories arbitraires, au XVIe siècle surtout, les érudits introduisirent dans les mots français un grand nombre de lettres qui n'avaient pas de raison d'être. L'Académie, à chaque édition de son dictionnaire, a laissé tomber un certain nombre de ces lettres étymologiques[1], mais il en est resté beaucoup. On a cru que *lais*, substantif verbal de *laisser*, venait de *legatum*, et on en a fait "legs"; le *d* de "poids" est emprunté de *pondus*, tandis que "poids" est dérivé de *pensum*; "heur" descend d'*augurium*, mais par ignorance on l'a rattaché à *hora*, et de là l'*h* initiale; etc.

Ajoutons à cette déformation des mots par les savants l'action de la force conservatrice, suffisante à elle seule pour empêcher l'orthographe de rattraper la prononciation, et nous connaîtrons les causes du désaccord qui existe aujourd'hui entre la forme écrite et la forme parlée du langage français.

A débarrasser l'orthographe des lettres parasites, des anomalies que rien ne peut justifier, à réformer les mots qu'une fausse science a jadis défigurés, travaillent les réformistes, du moins les modérés. Ils veulent des réformes, mais des réformes lentes, progressives, partielles, faites avec mesure, avec opportunité; ils veulent qu'il ne soit donné satisfaction qu'aux réclamations motivées. Ils visent "non pas à simplifier l'orthographe, mais à la rendre plus correcte; et il se trouve qu'en devenant plus rationnelle, elle devient aussi plus facile". Ces réformateurs, et parmi eux les plus habiles grammairiens de notre temps, demandent en un mot que soient reprises, que soient poursuivies les "corrections" orthographiques qui ont signalé chaque nouvelle édition du dictionnaire de l'Académie française. Ils ont à vaincre un obstacle, un seul, et qui se trouve au fond de tous les arguments qu'on leur oppose; c'est la résistance de l'habitude. Leurs adversaires oublient combien vite se prennent des habitudes nouvelles et qu'une réforme logique ne nous ferait pas éprouver plus de gêne qu'à nos pères les modifications successives déjà subies par l'orthographe et consacrées par l'Académie.

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[1] En 1740, les réformes adoptées atteignirent près de 5,000 articles sur 20,000.

Nous ne parlons pas ici des "doctrinaires du phonétisme". Les modifications que ceux-ci préconisent, étendues, radicales, brusques, sont souvent maladroites. Leurs audaces effarouchent le public. Pour vaincre la résistance de l'habitude, pour la diminuer du moins, et aussi pour procéder sûrement, il vaut mieux "ne faire à la fois qu'un nombre restreint de changements, *sérier la réforme*", et la motiver.

Plusieurs programmes, depuis la "Pétition" de M. Louis Havet et la "Note" de M. Gréard, ont été élaborés par les réformistes modérés.

M. Léon Clédat, doyen de la Faculté des Lettres de l'Université de Lyon, met en pratique, dans sa *Revue de philologie française et de littérature*, un système orthographique approuvé par MM. Michel Bréal, Edouard Hervé, Francisque Sarcey, Ferdinand Brunot, Louis Havet, Charles Lebaigue, Eugène Monseur:

"1. Remplacer par *s* l' *x* final valant *s*, sauf dans les noms propres et noms de lieux.

"2. Ecrire par *s* ou *z* *deusième*, *troisième*, *sisième*, *disième*, *disaine*, ou *deuzième*, etc.

"3. A l'indicatif présent des verbes en *re*, *oir*, et *ir*, terminer toujours par un *t* la troisième personne du singulier, et supprimer toute consonne qui ne se prononce pas devant l'*s* des deux premières personnes et devant le *t* de la troisième: *je m'assiés*, *il s'assiet; je cous*, *il cout; je prens*, *il prent; je pers*, *il pert; je convains*, *il convaint; je permès*, *je combas*, *j'interrons*.

"4. Ne jamais redoubler l'*l* ni le *t* dans les verbes en *eler* et en *eter*.

"5. Ne jamais faire l'accord du participe quand le complément direct est le pronom *en*, et quand le participe est suivi d'un infinitif sans préposition ou d'un prédicat. Faire ou ne pas faire l'accord, sans y attacher aucune importance, pour les participes *coûté* et *valu*, qu'ils soient pris au propre ou au figuré."

Ce dernier article est relatif à l'orthographe de règle. Une brochure de M. Clédat sur l'accord du participe passé, parue en 1889, renferme un clair exposé de cette question.

Le savant grammairien a aussi discuté, dans la *Revue de philologie*, chaque article de son programme et a démontré que sa réforme, "bien que partielle, supprime déjà une vingtaine de règles, exceptions ou remarques des grammaires, qui ne peuvent se justifier par aucun argument sérieux." (*Revue de philologie*, t, III, p. 270; t. IV, pp. 85, 153, 161, 245; t. pp. 81 et 308.)

Mais le but de cette étude est de présenter quelques observations sur l'histoire qu'on pourrait dire *officielle* de la réforme depuis 1901,

plutôt que de faire connaître tous les projets qui ont été émis, depuis les propositions révolutionnaires du *Réformiste* jusqu'aux suggestions de M. Alfred Dutens dans son *Etude sur la simplification de l'orthographe.*[1]

Le 5 décembre 1901, MM. Belot, Bernès, Clairin et Devinat soumettaient au Conseil supérieur de l'Instruction publique de France six nouvelles propositions de réforme, et formulaient le vœu que, selon une procédure analogue à celle qui avait été suivie pour l'enseignement de la syntaxe et avait abouti à l'arrêté du 26 février 1901, une commission fût constituée pour étudier le nouveau projet. Un arrêté ministériel, pris le 11 février 1903, constitua en effet une commission chargée d'examiner les six propositions et de préparer un projet de simplification de l'orthographe française. Cette Commission était composée de MM. Bernès, Clairin, Comte, Croiset, Devinat, Gréard, Meyer, membres du Conseil Supérieur de l'Instruction publique, Havet, de l'Institut, Brunot et Thomas, professeurs à l'Université de Paris, Carnaud et Carnet, députés. Gaston Paris devait présider la Commission; mais la mort vint frapper le savant philologue avant qu'elle eût commencé son travail, et le Comité de réforme fut présidé par M. Paul Meyer.

Voici le texte des nouvelles propositions que devait étudier la Commission:

"1. Francisation des mots d'origine étrangère qui sont définitivement entrés dans la langue et répondent à un besoin réel;

"2. Unification de l'orthographe et accentuation entre mots d'une même famille;

"3. Simplification des consonnes doubles *ph*, *th*, *rh*, *ch* dur;

"4. Simplification des consonnes dupliquées, quand elles sont, pour tous les mots d'une même famille, entièrement disparues du meilleur usage de la prononciation, et qu'elles sont inutiles pour conserver, entre les mots français et les mots latins ou grecs dont ils sont dérivés, ces analogies de forme extérieure qui sont pour la mémoire de précieux auxiliaires;

"5. Suppression des pluriels en *x;*

"6. Substitution de l'*i* à l'*y* de même son."

Ces réformes étaient-elles toutes également logiques, également rationnelles ?

Les propositions 3, 5 et 6 pouvaient et peuvent encore se justifier facilement.

PROPOSITION 3.—Cette réforme, autrefois demandée par Voltaire, par Didot, par Sainte-Beuve, étendrait à tous les mots où se

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[1] Paris (du Rudeval), 484 pages.

rencontrent les consonnes doubles *ph*, *th*, *rh* et *ch* dur, une orthographe déjà consacrée par le meilleur usage. On écrivait autrefois "phantaisie", phlegme", "phiole", "phantôme", "phrénésie", "throne" "thrésor", "rhétine", "rhapsode", "échole", "mélancholie", "cholère", "charactère", "chorde", "paschal", "monachal", "méchanique", etc.; aujourd'hui, on écrit "fantaisie", "flegme", "fiole", "fantôme", "frénésie", "trône", "trésor", "rétine", "rapsode", "école", "mélancolie", "colère", "caractère", "corde", "pascal", "monacal", "mécanique", etc. Pourquoi n'écrirait-on pas aussi *filosofie*, *téâtre*, *réteur*, *arcange*, etc? On trouve bien "patétique" dans LaBruyère; "misantrope" dans Molière: "ortographe" dans Corneille; "tèse", "bibliotèque", "métafisique", "apoticaire", "téologien", "entousiasme", "crétien", "catécumène", dans Voltaire......

L'*h*, dans ces groupes, rappelle, dit-on, l'orthographe du mot grec....Mais le rôle des lettres est de représenter les sons français, non de rappeler la forme écrite d'une source étymologique. Un mot étranger, pour devenir entièrement français, doit être soulagé des lettres parasites que sa naturalisation phonétique laisse tomber; à plus forte raison, un mot emprunté à une langue qui n'a pas le même alphabet. Dans les mots de formation populaire, voyez quel mépris des lettres étymologiques: *gabata* a fait "joue," *libella* a donné "niveau", *muscionem* a abouti à "moineau", et cela est très régulier. M. Gréard préconise cette simplification des groupes *rh*, *ph*, *th*, et *ch* dur. Il rappelle qu'en 1878 l'Académie supprima une des deux *h* dans "diphthongue", dans "phthisie" et dans "rhythme", et écrivit "diphtongue", "phtisie", "rythme", pour le motif que "dans les mots tirés du grec, il n'y a pas d'inconvénient à retrancher une lettre, quand cette lettre ne se prononce pas". Rien de mieux, ajoute M. Gréard; "mais pourquoi, dans les mots qui en ont deux, supprimer l'une plutôt que l'autre"?

PROPOSITION 6.—L'Académie a déjà admis la substitution de *i* à *y* dans "cristal", "asile", "chimie", "abîme", "cime", "colisée", "satirique", "giratoire", "anévrisme", "amidon", etc. Les réformistes voudraient simplement écrire aussi *analise* comme faisait l'Académie elle-même dans la cinquième édition de son Dictionnaire (1798), *stile*, *péristile*, *hiperbole*, *tim* comme Labruyère, *mistère*, *tiran*, *tipe* comme Bossuet et Mme de Sévigné, *piramide*. *sindic*, *enciclopédie* comme Voltaire, etc.[1]

PROPOSITION 5.—Sur la suppression des pluriels en *x* je citerai une causerie faite à Lausanne, le 18 octobre 1902, par M. Léon Clédat,

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[1] La *Note* de M. Gréard recommandait aussi cette substitution.

devant la *Société suisse de Réforme orthographique.* M. Clédat a bien voulu m'indiquer lui-même ce passage de son étude et m'autoriser à le produire.

"Faut-il refaire, dit M. Clédat, l'histoire de l'*x* final? L'article pluriel "les" s'écrit par *s*, comme en latin (*illos*), et nous le changeons en *x* dans "aux" pour "à les"! L'*s* est la lettre caractéristique du pluriel, que nous avons héritée de la déclinaison latine. Par quel mystère doit-on lui substituer un *x* dans "choux" qui vient de *caules*, dans "royaux" qui vient de *regales*, dans "lieux" qui vient de *locos*, etc.? Pourquoi l'*s* des féminins "mauvaise", "curieuse" est-elle représentée par *s* dans le masculin "mauvais" et par *x* dans le masculin *curieux*? Il n'y a pas trace d'*x* dans le latin *curiosus*. Quelle peut être la signification de l'*x* dans "prix" qui vient de *pretium* tandisque "palais", qui vient de *palatium*, prend un *s*? Pour "noix", on allèguera *nux*, mais nous savons aujourd'hui que ce mot vient de *nucem*. D'ailleurs si on écrit "noix" à cause de *nux*, pourquoi ne pas écrire *roix* à cause de *rex*? Voilà toute une série de pourquoi auxquels on eût été bien embarrassé de répondre au dix-huitième siècle. Aussi conservait-on toutes ces bizarreries, faute de pouvoir donner de bonnes raisons pour les supprimer. La philologie moderne a trouvé le secret de l'énigme, et le voici. Antérieurement au quinzième siècle, nos ancêtres écrivaient très régulièrement "aus", "royaus", "curieus", "pris", "nois". Mais les copistes, pour économiser le temps et le parchemin, remplaçaient souvent *us*, terminaison très fréquente, par deux signes abréviatifs, tout conventionnels, dont l'un ressemblait à un *z* et l'autre à un *x*. On écrivait "chevaus", ou "cheva" suivi de ce faux *z* ou de ce faux *x* valant *us*. Mais il arriva que par inadvertance, tout en employant ce signe abréviatif, on écrivit l'*u*, qui se trouvait ainsi exprimé deux fois. La faute tourna en habitude, on confondit tout à fait le signe abréviatif avec un *x* et on en vint à considérer l'*x* comme l'équivalent de l'*s* dans les mots terminés par *us*: on écrivait dès lors "chevaux", "glorieux", "tu veux", et on mit aussi l'*x*, qui n'avait plus que la valeur de l'*s*, à quelques autres mots, notamment à ceux dont le nominatif latin finissait par cette consonne: "six", "voix", "paix", "croix". Par imitation de "six", on a mis aussi un *x* à "dix" qui n'en avait pas en latin, et même à "prix", qui n'en avait pas d'avantage, si bien que l'*x* du substantif "prix" dérive de l'*x* final du nom de nombre "six"! "Six" a engendré "dix", et "dix" a produit "prix".

"C'est ainsi que l *x* final est le résultat et la consécration d'une erreur grossière.

"Quelques mots en *us* échappèrent comme par miracle à la déformation qui atteignait les autres: le pluriel de "bleu", "je meus",

le pluriel d'un bon nombre de noms en *ou* Ce sont ceux-là qui représentent la saine et bonne tradition à laquelle il faut ramener les autres, en ne laissant plus à l'*x* que sa valeur exacte de consonne double ($k + s$) dans les mots tels que "silex", "exterminer", etc., et en redonnant à l'*s* la place qui lui appartient."[1]

A ce témoignage ajoutons celui d'un autre grammairien non moins autorisé.

Voici comment M. Ferdinand Brunot démontre que l'*x* du pluriel a été introduite par erreur dans notre orthographe (*Gram. hist.*, par. 206, 4ème édition, p. 252):

"L devant *s* comme devant d'autres consonnes se vocalisait en *u*: des *chevals* donnait des "chevaus", comme *alba* donnait "aube".

"Or, au moyen âge, il était d'usage de remplacer le groupe *us* par une abréviation qui fut tour à tour ∞ et *x*, qu'on plaçait au-dessus de la ligne et ensuite sur la ligne même. Ainsi: "cheva ∞".

"Ce signe se confondit avec la lettre *x*, et dans l'*x* de "chevax" on vit une notation particulière représentant *s*. Or, comme on entendait un *u*, on le rétablit dans l'écriture. On eut: "chevaux".

"A la Renaissance, on alla plus loin encore, on introduisit le *l* étymologique. De là l'orthographe du XVIe siècle, "chevaulx", qui littéralement représentait "chevauuus", trois fois le *l* vocalisé.

"Dès le XVIIe siècle on est revenu à l'orthographe "chevaux", que nous conservons encore aujourd'hui, orthographe encore erronée, puisque *x* n'a pas de raison d'être, et n'a été introduite dans ces mots que par confusion."

A cause de l'importance de cette question des pluriels en *x*, nous citerons aussi Darmesteter (*Cours de Gram. hist. de la langue française*, t. I, par. 106, seconde édition, p. 138):

"La langue moderne écrit "chevaux", "vaux", avec *x* au lieu de *s*. Pourquoi cette *x*?

"Le moyen âge employait l'*x* comme signe abréviatif du groupe *us*. Ce qu'on prononçait *Deus* devenait "Dex"; ce qu'on prononçait *nous*, *vous* pouvait s'écrire "nox", "vox". Il était tout naturel qu'on écrivît également "chevax", "vax", en prononçant *chevaus*, *vaus*. Vers la fin du moyen âge, quand l'usage des abréviations tendit à disparaître, ou oublia la valeur du signe *x* et on le confondit avec la lettre *x* qu'on prit dès lors pour un substitut de l'*s*. Comme on faisait entendre la voyelle *u* dans la diphtongue *au*, on fit reparaître cette voyelle et on écrivit "chevaux" ou "vaux".

[1] Cette *Causerie* est imprimée dans le *Bulletin de la Société suisse de Réforme orthographique*, (mars 1903) suivant le système de cette publication, qui met en pratique un programme très étendu.

"Quelques-uns même, ne comprenant pas que l'*l* du singulier était déjà représentée au pluriel par l'*u*, allèrent jusqu'à écrire "chevaulx", ou "vaulx". A partir du XVIIe siècle, on supprima généralement cette *l* du groupe *aus*, sauf dans les deux mots "aulx" (plurielde "ail") et "faulx" (*falcem*). Les noms en *al* firent désormais leur pluriel en *aux*.

"C'est à cette succession d'erreurs qu'est due la fâcheuse habitude de l'orthographe moderne de noter par *x* presque toute *s* qui suit *u* ,non seulement dans les mots où l'*u* représente une ancienne *l* ("chaux", "faux", "doux",) mais dans bien des cas où l'*u* ne vient pas de la liquide ("glorieux", "nerveux", "je peux"). Il serait grand temps qu'une orthographe plus correcte et plus simple rétablît partout l'*s* finale à la place de cette *x* barbare."

C'est encore à propos de cette réforme des pluriels en *x*, que M. Gréard, dans sa *Note* présentée le 16 février 1893 à la commission du Dictionnaire de l'Académie française, écrivait:

"Dieu nous garde de vouloir faire de la langue une langue monotone! Dieu nous garde surtout de toucher aux idiotismes qui en sont le nerf et la grâce! Mais autre chose est le tour original, primesautier, donné à la pensée et où se traduit, où éclate le génie d'un peuple, autre chose ces bizarreries de vocabulaire qui ne sont que des habitudes vicieuses créées par une sorte de caprice et tolérées par une tradition irréfléchie ou aveugle."[1]

Voilà, ce semble bien, des motifs qui devaient dissiper tous les doutes sur la légitimité de l'article 5 des "nouvelles propositions".

Les trois autres articles, le 1er, le 2ème et le 4ème, comportaient des réformes peut-être moins heureuses. On les trouvera discutées dans un remarquable article de M. A. Schinz, professeur au Collège Bryn Maur (*Modern Language Notes*, février 1914, p. 38). Sans adopter toutes les vues du distingué professeur, on ne peut contester qu'il ait raison sur plus d'un point.

PROPOSITION 1.—M. Gréard avait touché cette question de la francisation des mots étrangers. L'arrêté de 1901 lui avait donné en partie raison, en déclarant que les mots d'origine étrangère qui sont "tout à fait entrés dans la langue française" peuvent former leur pluriel régulièrement, par l'addition d'une *s*. Ainsi, "soprano" peut maintenant s'écrire, au pluriel, "sopranos" aussi bien que "soprani".

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[1] La *Note* de M. Gréard, "admirablement étudiée et merveilleusement écrite," a d'abord été publiée dans la *Revue universitaire* du 15 février 1893. Elle a été souvent reproduite. On la retrouvera dans le *Dictionnaire de la prononciation française* de Favre.

Le nouveau projet allait plus loin. Il demandait la francisation complète des mots d'origine étrangère.

Le principe est admis depuis longtemps: les mots étrangers qui ont définitivement acquis le droit de cité chez nous doivent être naturalisés dans leur forme écrite.

Mais dans quelles conditions et à quelle époque cette francisation des formes écrites doit-elle s'opérer? "Francisation dit le projet, des mots d'origine étrangère *qui sont définitivement entrés dans la langue et répondent à un besoin réel.*"

Quel "besoin réel" avons-nous du plus grand nombre des mots étrangers, anglais surtout, qui envahissent aujourd'hui le français? Quel besoin de *steamer*, de *smoking room*, de *blockhaus*, de *railway*, de *meeting*, de *foot-ball*, de *rosbif*, de *steeple-chase*, de *bifsteck*, de *groom*, de *spleen*, de *gentleman*, etc., quand nous avons "vapeur", "fumoir", "fortin", "chemin de fer", "réunion", "ballon", "bœuf rôti," "course au clocher", "bœuf grillé", "garçon", "mélancolie", "gentilhomme", etc.? Autant de doublets. L'Académie en a admis un grand nombre; plusieurs déplorent l'engouement auquel elle a cédé.[1]

Du reste, il ne doit pas suffire qu'un terme étranger apporte avec lui une idée nouvelle, si cette idée ne prend pas au dépourvu les ressources linguistiques françaises. Pourquoi *skating*, *authoress*, etc., quand nous pouvons former "patinoir", "autrice", etc.? Sans doute, il y a des mots étrangers nécessaires; et s'ils sont nécessaires, ils se naturaliseront bien. "Mais, dit M. Remy de Gourmont, notre parler traditionnel ne doit pas accueillir tous les mots étrangers qu'on lui présente et nous ne devons pas prendre pour un enrichissement ce qui est le signe exact d'une indigence simulée."

Naturalisons les mots entrés dans la langue, disent les réformistes. Il nous parait que ceux-là ne sont pas entrés dans la langue, qui ne sont pas déjà francisés pour l'oreille. Car la francisation d'un mot étranger doit se faire sur les sons, non sur les lettres; le rôle de celles-ci est simplement de traduire le produit de l'opération. Peut-on dire, par exemple, que le mot anglais *plum-pudding* est mûr pour la francisation orthographique, quand on relève à Paris seize prononciations différentes de ce vocable?[2] Faut-il considérer comme entrés dans la langue les mots *walk-over*, *book-maker*, *betting*, *dead-heat*, parce que l'anglicisme est de mode aujourd'hui et qu'il plait à d'aucuns de se donner l'illusion de parler anglais? Et, parce que ces mots ont à Paris une prononciation hybride, ni anglaise, ni française,

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[1] Un éditeur de Paris publie actuellement une série de romans sous le titre général de *Modern-Bibliothèque*. Pourquoi pas "Bibliothèque moderne"?

[2] Voir Remy de Gourmont, *Esthétique de la langue fr.*, p. 96.

calquée sur l'écriture, doit-on déclarer qu'ils sont français et leur attribuer des formes écrites telles que "valcover", "boucmacaire", "bétingue", "didite" ? [1]

Et qui décidera qu'un mot est ou n'est pas "définitivement entré dans la langue" ? L'Académie, suggère M. Renard, un des ardents défenseurs des "nouvelles propositions."[2] Mais l'Académie ne fait pas la langue; elle constate l'usage et le consacre. Quand de *boolwerk*, de *saebel*, le peuple eut fait "boulevard", "sabre", l'Académie enregistra ces mots; elle consacra leur orthographe après seulement que les sons étrangers eurent abouti dans le parler à la prononciation correspondante, c'est-à-dire, après leur francisation phonétique. Autrefois, en effet, c'était par la parole, non par l'écriture, que les éléments étrangers s'introduisaient dans la langue, et le peuple, forgeur de mots, les façonnait à sa guise: de *bowsprit*, il faisait "beaupré". Aujourd'hui, les mots d'Outre-Manche sont portés en France par le livre, le journal, la revue; ce sont les gens instruits qui font ces emprunts. Et voyez le résultat: ils ont lu le mot anglais *rail*, ils l'ont prononcé *raille*, et l'Académie a écrit "rail"; le peuple eût fait mieux, il eût naturalisé phonétiquement le mot et de *rail* il eût naturellement fait *raile*. C'est le traitement que *rail* a subi au Canada: nous n'avons pas lu le mot anglais, nous l'avons entendu, et nous disons très bien *raile*. Cette forme a aussi l'avantage de rappeler le vieux mot normand d'où est sorti l'anglais. *Raile*, voilà une forme naturalisée phonétiquement, mûre par conséquent pour la naturalisation orthographique[3]; mais l'Académie ne peut adopter cette orthographe, qui ne représente pas le son que les Français attribuent au nouveau mot; elle ne peut écrire que "rail". Et "rail" a donné le verbe "dérailler", tandis que *raile* donnait chez nous *dérailer*, qui est meilleur. D'ailleurs, "quel besoin, dit M. Gréard, d'aller prendre aux Anglais le mot "rail", alors que nous trouvions chez nous le mot si français de "rais", un mot si expressif et si bien dérivé de *radius*[4]! Et voyez la conséquence! De "rail" on a tiré "dérailler" qui semble répondre à "railler", se moquer, alors que *dérayer* découlait si naturellement de "rais". N'eût-il pas été possible aussi de dire *dérailer* ?"

Que pourrait faire l'Académie de *high-life*, de *five-o'clock*, de *coaching*, de *yachting*, etc.?.... Des mots barbares, "ilots anglais perdus dans la langue", et dissimulant mal leur nationalité. Comment fixer l'orthographe de mots dont la prononciation varie avec

[1] Voir R. DE GOURMONT, *op. cit.*, p. 94.

[2] *La Revue*, 15 juillet, 1902.

[3] Darmesteter aurait voulu qu'on écrive *rel*. (*Gram. de la langue française.*)

[4] Ajoutons: . . . quand on pouvait dire "lisse," comme au Canada.

le caprice du jour? *Clown*, à Paris, se prononce "cloune", mais *broken-down* se dit "brocandeau"! On écrirait donc "cloune", et "brocandeau"....Pourquoi ce traitement différent du groupe *ow? Bowl* est devenu "bol" en français; et voilà que *bowl-punch* fait "bouleponche"! Si l'on veut simplifier l'orthographe, pourquoi demander la consécration de ces anomalies?....

La façon dont les mots anglais s'introduisent aujourd'hui dans le français crée un obstacle presque insurmontable à leur francisation orthographique. Quoi qu'on fasse, leur naturalisation phonétique n'offrant aucune garantie de régularité, ces mots sont dans la langue comme des corps étrangers; tôt ou tard, à moins que le peuple s'en empare, les refonde dans les vieux moules, les forge sur sa dure enclume, il faudra les éliminer. Au lieu d'habiller à la française ces produits exotiques, que ne cherche-t-on à les expulser? du moins, que n'attend-on qu'ils soient acclimatés? Un trop grand nombre déjà ont été reçus, qui gâtent le vocabulaire.

Proposition 2.—"Unification de l'orthographe et de l'accentuation entre les mots d'une même famille". Faudrait-il donc écrire *selière* à cause de "sel," *merin* à cause de "mer", *parfection* à cause de "parfait", *foirain* à cause de "foire", *grainier* à cause de "grain", *bêtial* à cause de "bête", *forêtier* à cause de "forêt", *apôtolat* à cause de "apôtre", *nous boivons* à cause de "je bois", etc. M. Renard lui-même cite ces mots comme des exceptions à la réforme proposée, car, dit-il, "en passant du primitif au dérivé, un son se modifie souvent".

A quels mots s'appliquerait donc la proposition 2ème? Ecrira-t-on *monarch* pour "monarque", à cause de "monarchie"? Mais, d'après les auteurs du projet, *ch* dur doit être simplifié. M. Renard donne pour exemple "choléra" et "catéchumène"; mais ces deux mots ne sont pas d'une même famille. D'ailleurs, tous les mots où se rencontre le *ch* dur tombent sous le coup de la proposition 3. "C'est une absurdité, dit encore M. Renard, d'écrire "essence" et "confidence" avec un *c* mais "essentiel" et "confidentiel." avec un *t*, alors qu'on écrit avec un *c* "circonstance" et "circonstanciel". Si l'on adopte cette proposition, répond M. Schinz, "confidence" et "confidentiel" auront d'avantage l' "air de famille", mais que ferez-vous de "confident"? Si vous écrivez *confidenciel*, pourquoi ne pas écrire aussi *parciel*, qui est pourtant de la même famille que "part", "partie", etc.?

Si l'on pousse le principe jusqu'à ses dernières limites, ou bouleverse tout le vocabulaire; si l'on s'arrête en chemin, on augmente le nombre des anomalies.

PROPOSITION 4. — "Simplification des consonnes dupliquées". Telle que proposée, la question soulève des questions délicates; elle compliquerait peut-être, plutôt qu'elle ne simplifierait, l'orthographe.

On aurait mieux fait, sans doute, de réclamer seulement, avec M. Gréard, la suppression des contradictions que les consonnes dupliquées créent entre les mots de même famille ou de famille analogue; "souffler" et "boursoufler", "abatteur" et "abatage", "apparaître" et "apercevoir", etc., ou encore, avec M. Clédat, la simplification des consonnes dupliquées dans les verbes en *eler* et *eter*.

Le mouvement de la réforme orthographique n'est donc pas sans danger. "Il est à craindre, c'est par ces mots que M. Schinz termine son article, que les réformistes se laissent entraîner trop loin, qu'ils sacrifient, pour une similitude apparente entre deux termes, des règles d'une simplification plus étendue et qui gouvernent un grand nombre de mots....Une réforme trop radicale jetterait la confusion dans l'orthographe",

Aussi, lorsque furent publiées les nouvelles propositions, exprima-t-on le désir que la réforme fût dirigée par les plus éclairés d'entre les grammairiens français.

La Commission de 1903 examina et discuta, dans plus de 20 séances, les six propositions, et adopta un certain nombre de solutions, que M. Meyer fut chargé de résumer dans son rapport.

Ce rapport, imprimé au mois d'août 1904, mais tenu secret par ordre du Ministère de l'Instruction publique, ne fut vraiment connu du public que plus tard, quand il parut, en novembre, dans la *Revue Universitaire*. On nous permettra de rappeler que le *Bulletin du Parler français au Canada* en avait cependant eu communication auparavant et en avait publié les conclusions dès le mois d'octobre 1904.

Avant d'entrer en matière, M. Meyer indiquait quels principes avaient guidé la Commission. Il peut être intéressant de rappeler ces considérations d'ordre général:

"L'orthographe idéale serait celle qui figurerait chaque son par un signe unique, et qui, par conséquent, disposerait d'un nombre de signes égal au nombre des sons à noter. Cette conception du caractère et de l'objet de l'orthographe n'a évidemment rien de chimérique. Toutefois, appliquée à l'orthographe française, elle ne saurait aboutir à des résultats pratiques qu'à la condition de modifier d'abord en une assez grande mesure notre alphabet.

"La Commission n'avait point qualité pour entreprendre ce travail: le but assigné à ses études était plus rapproché et comportait des solutions immédiatement applicables. Elle n'avait pas à

réformer notre orthographe en la constituant sur des bases rationnelles. Elle devait simplement travailler à la simplifier, c'est-à-dire, dans les cas où divers modes ont été employés pour la représentation d'un son, choisir le plus simple et le plus clair de ces modes, et en faire l'application la plus générale possible. La Commission n'a même pas cru pouvoir suivre ce système avec une logique rigoureuse.... Dans l'avenir, on la taxera de timidité plutôt que de témérité, mais elle a pensé qu'il convenait de procéder avec prudence et que toutes les modifications désirables ne devaient pas être introduites à la fois. Elle est persuadée, d'ailleurs, que certaines des résolutions qu'elle a adoptées pourront être étendues dans l'avenir à des graphies qu'elle n'approuve pas, mais auxquelles, pour le présent, elle n'a pas voulu toucher. Surtout, elle s'est soigneusement gardée de proposer des changements qui, dans une réforme plus complète, ne pourraient être maintenus. Elle espère du moins que les nouvelles façons d'écrire qu'elle propose n'appelleront pas de modifications ultérieures et pourront être conservées dans tout système orthographique à venir.

"Cette perspective de réformes successives apportées à notre orthographe effraiera peut-être les personnes accoutumées à considérer la manière d'écrire une langue comme soumise à des règles fixes et immuables. Mais, puisqu'on ne peut entraver la marche d'un idiome, puisqu'il est aussi impossible d'en fixer à tout jamais la prononciation que d'en arrêter définitivement le vocabulaire, il faut bien admettre que l'orthographe n'est pas une institution permanente et intangible, qu'elle doit au contraire subir de temps à autre des modifications pour rester en accord avec la prononciation. Du reste, il suffit d'une connaissance même superficielle de l'histoire de notre langue pour se persuader que rien n'a été moins immuable que notre orthographe. Sans remonter aux temps anciens, où l'écriture n'était assujettie à aucune règle fixe, où chacun notait les sons selon sa propre prononciation, d'après des méthodes assez vagues, à ne prendre comme point de départ que la première édition du dictionnaire de l'Académie (1694), on remarque que chaque édition nouvelle de ce dictionnaire a changé l'écriture de mots nombreux....Seulement, beaucoup des changements ainsi introduits à différentes époques, et dont la plupart méritent d'être approuvés, ont le défaut d'avoir été proposés sans vues d'ensemble et d'après une méthode incertaine. Dans tels mots on a supprimé des lettres qui ne se prononçaient plus (et qui dans plusieurs cas ne s'étaient jamais prononcées), dans tels autres on les a laissé subsister. Parfois même, par un retour en arrière, on a compliqué une orthographe qui avait été simplifiée. La troisième édition du dictionnaire de l'Académie écrit "dompter", quand les précédentes écrivaient "domter". On écrit

"charrier", "charriage" avec deux *r*, tandis qu'on les écrivait autrefois avec une seule, comme "chariot". Des irrégularités de ce genre compliquent bien inutilement l'étude de notre langue et risquent par surcroît d'en corrompre la prononciation. La Commission s'est efforcée de les supprimer tout en innovant le moins possible. A vrai dire, elle n'a rien innové du tout. Entre les modifications qu'elle propose, et qui ont toutes pour but de noter plus simplement et plus clairement les sons, il n'en est aucune qui ne soit autorisée par l'analogie ou par l'histoire de la langue. Dans beaucoup de cas, elle n'a eu qu'à recourir à l'ancien usage pour trouver la forme la meilleure. Au cours de son examen, elle a rencontré beaucoup de lettres, dites étymologiques, qui n'ont aucune valeur phonétique ni historique. Elle les a, le plus souvent, supprimées. Les critiques qui lui seront adressées de ce chef ne l'émeuvent guère. Les linguistes, dont c'est le métier de trouver l'origine des mots, ne demandent pas à l'orthographe de les guider dans leurs recherches: ils lui demandent seulement, comme tout le monde, de représenter les sons le mieux possible."

Puis M. Meyer exposait les changements proposés par la Commission.

Pour que cette petite histoire du mouvement réformiste *officiel* soit complète, et pour qu'on puisse mieux juger jusqu'où allaient les membres de la Commission, et jusqu'où l'Académie a refusé de les suivre, nous donnons un résumé sommaire des conclusions du *Rapport*, sans les discuter cependant, car, en examinant les six propositions, nous avons étudié les mêmes questions.

Voici les divers changements proposés par la Commission:

SIGNES DIACRITIQUES.

Accents.—L'accent grave est réservé à la lettre *e* marquant le son *e* ouvert (*è*).

On écrira donc, sans accent, *a* pour "à", *ou* pour "où", *la* pour "là", *déja* pour "déjà", et d'autre part, avec l'accent grave, *évènement* pour "événement" (cf. "avènement"), *cèderai*, *règlerai*, *complèterai*, et de même tous les mots où *e*, suivi d'une syllabe où se trouve un *e* muet, marque le son ouvert. Cette règle ne s'appliquera pas aux particules *e* et *de*, en composition, dans les cas où la prononciation fermée de l'*e* est bien établie ("égrener", "dégrever", etc.).

CONSONNES.

Consonnes Parasites.—Règle générale, toutes les consonnes parasites non prononcées sont supprimées. On écrira donc: *cors* (corps), *las* (lacs), *ni* (nid), *neu* (nœud), *doit* (doigt), *pois* (poids),

puis (puits), *rempar* (rempart), *sculter* (sculpter), *set* (sept), *vint* (vingt), etc., *donter* (dompter), *pront* (prompt), *tens* (temps), etc.

Aux trois premières personnes de l'indicatif présent des verbes, où s'est introduit un *d* qui ne se prononce pas et qui, à la troisième personne, sonne *t* dans les cas de liaison, ce *d* est supprimé et remplacé par *t* à la troisième personne: *je prens*, *il prent* (je prends, il prend), *je cous*, *il cout* (je couds, il coud), etc.

De même, le substantif "différend" s'écrira comme l'adjectif: "différent"; "fond" s'écrira sans *s* dans tous les cas. Le *t* est rétabli dans "appas", qui n'est que le pluriel d'"appat".

CONSONNES DOUBLES SUIVIES D'*E* MUET. LL.—Sauf les cas où *ll* marque la mouillure, ce signe double est réduit à *l*. (On écrira *apèle*, *apèlerai*, *cole*, *vile*, *bule*, etc., au lieu d'"appelle", "appellerai," "colle", "ville", "bulle", etc., mais "bille", "fille", etc.)

RR.—*RR* est dans tous les cas réduit à *r* simple. (On écrira donc *bécare*, *beure*, *boure*, *guère*, etc., et non "bécarre", "beurre", "bourre", "guerre", etc.)

MM, NN.—Ces deux groupes sont réduits à *m* et à *n* simples. (*Fame*, *some*, *cane*, *bone*, etc., pour "femme", "somme", "canne" "bonne", etc., *ènemi*, *prène*, *anciène*, *viène*, *etc.*, pour "ennemi", "prenne", "ancienne", "vienne", etc.)

TT.—Même proposition. (On écrira *nète*, *jète*, *quite*, *sote*, *goute*, etc., pour "nette", "jette", quitte", "sotte", "goutte", etc.)

PP et FF.—La Commission propose l'emploi général de la consonne simple.

CONSONNES DOUBLES SUIVIES D'UNE VOYELLE SONORE. LL.—La Commission propose de réduire *ll* à *l* simple dans tous les cas où la prononciation le permet. (On écrira *osciler*, *scintiler*, *vaciler*, *alécher*, *alégresse*, *alié*, *alouer*, *alumer*, *balon*, *colection*, *colège*, *colier*, *imbécilité*, *soliciter*, etc.; mais, à cause de la prononciation reçue, "allocation", "allusion", "collaborer", "illégal", "colloque", "ellipse", "belliqueux", etc.)

RR.—Même réforme que pour *ll*. (On écrira *corélatif*, *corespondre*, *amarer*, *bareau*, *beurer*, *bourer*, *caré*, *carière*, *charète*, *charue*, etc., mais "courrai", "mourrai", "irréductible", "interrègne", etc.)

MM.—L'orthographe actuelle est conservée dans tous les cas où la double *m* se prononce ("commémorer", "commotion", "immense" etc.), mais dans tous les autres cas elle est simplifiée (*accomoder*, *assomer*, *comander*, *comètre*, *comode*, *comun*, *enflamer*, etc.). La même règle est appliquée aux mots où la première *m* donnait autrefois à la voyelle précédente une prononciation nasale (*ardament*, *évidament*,

prudament, etc.). Pour les mots où la première *m* du groupe nasalise encore la voyelle précédente, la Commission propose la graphie *enm* (*enmailloter*, *enmener*, etc., pour "emmailloter", "emmener", etc.

NN.—L'*n* double est conservée dans les mots de formation savante et tardive où elle se prononce ("inné", "innombrable", etc.); dans tous les autres cas elle est simplifiée (*abandoner*, *anée*, *anuel*, *aniversaire*, *aneau*, *anoncer*, *conaitre*, etc., pour "abandonner", "année", etc.)

CC.—La Commission ne conserve les deux *c* que dans les cas où la prononciation les fait sentir ("occulte", etc.) et dans ceux où le second *c* a le son sifflant ("occire", "occident", etc.) Dans tous les autres cas, la Commission propose le retour à la graphie du moyen âge et par conséquent la réduction du double *c* au *c* simple (*bacalauréat*, *ocuper*, *bacante*, etc., pour "baccalauréat", "occuper", "bacchante", etc.) Par suite, elle propose *aquérir*, etc., au lieu d'"acquérir", etc.

GG.—Sauf les cas où le second *g* a le son palatal, comme dans "suggestion" (voir plus loin), le *g* double est réduit à *g* simple (*aglomérer*, *agraver*, etc.)

TT.—Simplification dans tous les cas (*abateur*, *atendre*, etc.)

DD.—Le *d* doublé est conservé là où il est admis dans la prononciation ("addition", "reddition", etc.); on ne le rencontre guère que dans ces mots.

PP et BB.—Réduction, sauf dans les mots récents où la prononciation est d'accord avec la graphie, comme "hippique", etc. (On écrira donc *oportun*, *opression*, *oprobre*, *abesse*, etc.)

FF.—Dans tous les cas, *ff* est réduit à *f* simple (*afaire*, *afamer*, *afection*, *afirmer*, etc.).

SS.—Dans les composés où le deuxième terme composant commence par *s*, la Commission rétablit l'*s* simple (*asembler*, *resentir*, *resouvenir*, *etc.*) et, dans les cas où la voyelle qui précède est *e*, marque cet *e* d'un accent si la prononciation l'exige (*désaisir*, *présentir*, etc.). La graphie *ss* est conservée dans les autres cas.

D'une manière générale, on peut donc dire que, sauf l'*s* doublée, la Commission propose de déduire les consonnes doubles dans tous les cas où la prononciation ne les fait pas sentir.

CONSONNES SIMPLES.

H.—L'*h* muette est conservée, sa suppression paraissant inopportune.

G.—La Commission substitue partout *j* à *g* palatal. (On écrira donc *manjer*, *manjons*, *obliger*, *oblijant*, etc.)

T.—Le *t*, quand il représente la sifflante forte, est éliminé et remplacé par *c*. (On écrira *aristocracie*, *inercie*, *parcial*, *inicier*, *saciété*, *nocion*, *nacion*, *faccion*, etc.)

X.—L'*x* représentant la sifflante forte est remplacée par *ss*. (On écrira *soissante*, au lieu de "soixante", etc.) Représentant la sifflante faible, elle est remplacée par *z*. (*Dizième*, comme "dizaine", etc.)

De plus, l'*s* est substituée à l'*x* dans "six", "dix", "prix", "croix", etc. (qui s'écriront *sis*, *dis*, *pris*, *crois*, etc.) et dans les pluriels des mots en *al*, *ail*, *au*, *eau*, *eu*, *ou*. (On écrira donc, au pluriel, *chevaus*, *égaus*, *émaus*, *deus*, *bijous*, etc.

S.—Pour la sifflante faible, la Commission propose de substituer partout *z* à *s*. (On écrira donc *caze*, *extaze*, *chaize*, *tranziger*, *roze*, *ruze*, etc.)

16.—N mouillé.—L'*i* qui dans certains mots est placé devant le groupe *gn* représentant l'*n* mouillée et qui ne se prononce pas, est supprimé. (On écrira donc *mognon*, *ognon*, *pogne*, *pognard*, et non "moignon", "oignon," "poigne", "poignard".)

MOTS SCIENTIFIQUES VENUS DU GREC.

Dans les mots de cette classe, la Commission propose d'écrire *i* au lieu d'*y*, *t* au lieu de *th*, *f* au lieu de *ph*, *r* au lieu de *rh*, et *k* au lieu de *ch* suivi d'*e* ou *i*.

Telles sont, sommairement exposées, les modifications proposées par la Commission.[1]

Les objections qu'on pouvait lui adresser ne se réduisaient-elles pas à une question d'opportunité ?

La discussion s'engagea; les "grammairiens" demandaient la réforme; en général, les "littérateurs" s'y opposaient.

Aujourd'hui, on ne peut pas encore dire que la question est résolue; ces sortes de questions sont toujours ouvertes. Mais pour l'heure, la réforme est jugée, car on sait ce qu'en pense l'Académie française.

En effet, le projet fut soumis à l'illustre Compagnie, et le 9 mars 1905, elle adopta le *Rapport* de la Commission qu'elle avait chargée d'examiner les "propositions nouvelles".

Ce rapport, rédigé pour la Commission académique par M. Emile Faguet, donnait raison aux grammairiens sur quelques points; mais il était plutôt favorable aux littérateurs. L'Académie faisait

[1] Le rapport de M. Meyer, accompagné d'un mémoire, fut réimprimé et publié chez Delagrave: *Pour la simplification de notre orthographe*, in-8o, 52 pages.

tout de même un pas dans la voie de la simplification; et elle laissait clairement entendre qu'elle pourrait bien avant longtemps en faire un autre.

Cependant, cette décision n'a pas satisfait tout le monde. Les uns trouvent que le docte corps "s'encanaille"; les autres, et il est permis d'en être, que les "greffiers de l'usage" ne vont pas assez loin. On continuera donc à discuter. Les réformistes qui réclameront de nouvelles simplifications et les académiciens qui leur résisteront représentent bien les deux forces, révolutionnaire et conservatrice, dont parle Darmesteter, et qui sont nécessaires à la vie d'une langue; il reste à savoir, au regard de l'autorité de l'Académie, si la lutte est égale et dans quelle mesure il conviendrait qu'elle le fût.

Pour nous, nous n'avons qu'à enregistrer les résolutions de l'Académie.

Les observations dont l'Académie fait précéder ses conclusions peuvent se résumer en quelques lignes:

L'Académie repousse le principe de l'orthographe phonétique; elle se confesse très attachée à l'orthographe dite étymologique, assez attachée aussi à la "physionomie des mots", et surtout respectueuse de l'usage établi.

Elle rejette donc le plus grand nombre des propositions de la Commission; mais, reconnaissant qu'il y a des "simplifications désirables et qui sont possibles à apporter dans l'orthographe française", elle accepte, "sans toujours donner ses raisons, parce qu'elle adopte celles de la Commission et y renvoie", les réformes suivantes:

"1.—*Déja* (pour "déjà").

"2.—*Chute* (pour "chûte"), *joute* (pour "joûte"), *otage* (pour "ôtage"), modifications que l'Académie a déjà fait entrer dans son dictionnaire; et de plus *assidument* (pour "assidûment"), *dévoument* (pour "dévouement" ou "dévoûment"), *crucifiment* (pour "crucifiement" ou "crucifîment").

"3.—*Ile* (pour "île"), *flute* (pour "flûte"), *maitre* (pour "maître"), *naitre* (pour "naître"), *traitre* (pour "traître"), *croute* (pour "croûte"), *voute* (pour "voûte"), et autres mots où l'accent circonflexe ne sert qu'à rappeler l'*s* étymologique.

"4.—Elle admet que l'on écrive, *ad libitum*, "confidentiel" ou *confidenciel*, et les adjectifs analogues, c'est-à-dire ceux dont le substantif est en *ence* ou *ance*.

"5.—Elle accepte l'identification orthographique de "différent" et "différend", de "fond" et "fonds", de "appats" et "appas", en ce sens que l'on écrirait: "Un *différent* s'est élevé; un *fond* de terre; la retraite a pour vous des *appats*".

"6.—Elle accepte que l'on écrive, *ad libitum*, *enmitouffler* et "emmitoufler", *enmener* et "emmener", *enmailloter* et "emmailloter", et autres mots analogues où l'*n*, rencontrant *m*, est devenue *m*.

"7.—Elle accepte *ognon* pour "oignon".

"8.—Elle ne voit aucun inconvénient à ce que l'on écrive, "ad libitum", "pied" ou *pié*.

"9.—Elle accepte que les sept substantifs en *ou*, qui prennent un *x* au pluriel; "bijou", "caillou", "chou", "genou", "hibou", "joujou", "pou", rentrent dans la règle générale et prennent une *s* au pluriel.

"10.—Elle accepte *échèle* au lieu de "échelle", conformément à la prononciation et à l'étymologie.

"11.—Elle a décidé de régulariser l'orthographe des mots venant de *carrus*, en écrivant *charriot*, par deux *r*, comme s'écrivent tous les autres mots dérivés de *carrus*.

"12.—Elle est disposée, en examinant chaque cas, à ne pas s'opposer à la suppression de l'*h* dans les mots dérivés du grec où se rencontre la combinaison *rh*.

"13.—De même, notamment, pour les mots de création scientifique, elle aura pour tendance, de favoriser l'*i* plutôt que l'*y*.

"14.—Elle est favorable à la proposition d'écrire *sizain* comme on écrit "dizain" et "dizaine"; elle estime que l'on pourrait étendre cette réforme à *dizième* et *sizième* (au lieu de "dixième" et "sixième") par conformité avec "onzième" et "douzième".

"Telles sont les résolutions, dit le rapporteur en terminant, que, pleine d'estime pour les excellentes intentions de la *Commission chargée de préparer la simplification de l'orthographe française*, comme pleine de respect pour la compétence et le savoir de cette Commission, mais voyant quelquefois d'une façon différente les intérêts de la beauté et aussi de la facile propagation de la langue française, l'Académie a cru devoir prendre."

Quand on considère la prudence de l'Académie et que chaque mot de ces résolutions a été pesé, on ne laisse pas que d'être perplexe, s'il faut déterminer l'étendue de l'application de certains articles.

Par exemple, l'Académie, dans les résolutions 12 et 13, se déclare disposée à opérer certaines réformes qu'elle ne précise pas. Dans quels mots dérivés du grec supprimera-t-elle, "ayant examiné chaque cas", la dernière lettre du groupe *rh* ? dans quels groupes remplacera-t-elle *y* par *i* ? Faudra-t-il, pour le savoir, attendre la huitième édition de son dictionnaire ?

Trois autres articles s'appliquent à un certain nombre de mots que l'Académie n'énumère point: le 3ème, le 4ème, et le 6ème. En

effet, par la troisième réforme acceptée, l'Académie enlève l'accent circonflexe non seulement aux mots "île", "flûte", "maître", "naître", "traître", "croûte" et "voûte", mais aussi aux autres mots où cet accent ne sert "qu'à rappeler l'*s* étymologique"; par la quatrième, elle admet qu'on écrive, "ad libitum", par un *t* ou par un *c*, non seulement "confidentiel", mais aussi "les adjectifs analogues, c'est-à-dire ceux dont le substantif est en *ence* ou *ance*; enfin, par la sixième, elle accepte qu'on écrive, "ad libitum", par *m* ou *n*, non seulement "enmitoufler", "enmener", et "enmailloter", mais les "autres mots analogues où l'*n*, rencontrant *m*, est devenu *m*". A quels mots s'appliquera chacun de ces trois articles?

Art. 3.—Dans un assez grand nombre de mots français, l'accent circonflexe remplace une *s* étymologique; mais cet accent ne joue pas partout le même rôle: ici il marque un changement de timbre, en même temps que la chute de l'*s*; là il allonge la voyelle; ailleurs il n'exerce aucune influence sur le son. Il faut donc distinguer, pour déterminer les mots auxquels s'appliquera cette résolution de l'Académie.

L'accent marque-t-il, en même temps que l'amuïssement de l'*s*, une nuance du timbre, on le conservera, comme dans "hôtesse", "rôtir", "bât", "cloître", "croître", etc. Le supprimera-t-on dans "hôtel", "hôpital", etc.? Darmesteter prononce ces mots par *ó* fermé, Passy par *ò* ouvert. La suppression de l'accent rendrait-elle une confusion possible, comme dans "boîte", "faîte", etc., (qui se confondraient peut-être avec "boite", "faite", etc.), ou détruirait-elle une analogie jugée nécessaire, comme dans "prêt", etc. (cf. "prête", "prêter",), les principes posés par l'Académie montrent qu'elle entend conserver l'accent dans ces deux cas.

Mais, si l'accent circonflexe ne fait que rappeler l'*s* étymologique sans que le timbre soit altéré, il ne parait pas qu'il doive être maintenu pour la seule raison que la voyelle accentuée est longue. En effet, l'Académie l'enlève aux mots "île", "flûte", "maître", "naître", "croûte", où l'accent, non seulement remplace une lettre amuïe, mais encore surmonte une voyelle longue. Il faut donc penser que l'Académie veut supprimer l'accent circonflexe dans tous les mots où il ne fait que rappeler l'*s* étymologique, que la voyelle soit longue, moyenne ou brève; et l'on devra écrire sans acccent: "août, aoûtage, aoûté, aoûtement, aoûter, aoûteron, brûlable, brûlage, brûlant, brûlement, brûler, brûlerie, brûleur, brûlis, brûloir, brûlot, brûlure, bûche, bûcher, bûcheron, bûcheur, connaître, coût, coûtant, coûter, coûteusement, coûteux, croûte, croûtelette, croûteux, dîner, dînette, dîneur, disparaître, épître, flûte, gîte, gîter, goût, goûter, huître, huîtrier, huî-

trière, île, îlet, îlot, maître, maîtresse, maîtrisable, maîtrise, maîtriser, méconnaître, moût, naître, paître, il plaît, paraître, puîné, reconnaître, renaître, reparaître, repaître, traître, traîtreusement, traîtrise." Faut-il ajouter "bélître", qui a pris l'accent par analogie avec "épître"? L'Académie mentionne "traître" qui l'a pris par analogie avec "maître", et "voûte" dont l'accent vient de "coûte".

"Voûter" et "voûtis" suivront-ils le sort de "voûte" et perdront-ils l'accent?

"Flûte". Deux mots s'écrivent ainsi; l'un vient de *fusta*, l'autre est sorti du vieux français *flaüte* ou *fleüte*. Le dernier perdra-t-il aussi l'accent? Dans ce cas, il faudrait ajouter à la liste: "flûté", "flûteau", "flûter", "flûteur", et "flûtiste". L'Académie ne fait pas de distinction.

Enlèvera-t-on l'accent de "fût", par crainte de confusion avec "qu'il fût"? Le conservera-t-on, par crainte de confusion avec "il fut"?

Que fera-t-on de "genêt", "impôt", "prévôt", "protêt", "suppôt", "tôt", "aussitôt", "bientôt", "plutôt", "sitôt", "tantôt", où l'accent ne fait que rappeler l'*s* tombée? Les écrira-t-on comme "objet", comme "tripot"? "Genêt" et "prévôt" garderont sans doute l'accent, à cause de "genêtrière" et de "prévôtal"; mais les autres mots le perdront, si la règle nouvelle est appliquée telle que formulée par l'Académie.

Il est vraiment un peu difficile de dire jusqu'où l'Académie veut qu'on aille.

ART. 4.—Les adjectifs auxquels s'applique l'article 4 ne sont pas nombreux; ce sont, outre "confidentiel": "consubstantiel", "essentiel", "obédientiel", "providentiel", "pénitentiel", "pestilentiel", et "substantiel", qu'on pourra donc écrire: *consubstanciel*, *essenciel*, etc.

Mais les adverbes dans la composition desquels entrent ces adjectifs, "confidentiellement", "essentiellement", etc., pourront-ils s'écrire aussi, *ad libitum*, par un *t* ou un *c*? L'Académie n'en dit rien: et, comme elle n'admet pas que l'orthographe puisse "recevoir la logique comme remède", il faut attendre qu'elle se prononce là-dessus.

ART. 6.—Enfin, l'article 6 devra s'appliquer aux mots: "emmagasinage, emmagasinement, emmagasiner, emmaigrir, emmaillotement, emmailloter, emmanche, emmanchement, emmancher, emmanchure, emmanequiner, emmanteler, emmarchement, emmariner, emmarquiser, emmécher, emmêler, emmêlement, emménagement.

emménager, emmener, emmenoter, emmeublement, emmeubler, emmeuler, emmi, emmieller, emmiellure, emmitonner, emmitoufler, emmortaiser, emmotté, emmouffler, emmurer, emmuseler," qu'on pourra écrire aussi *enmagasinage*, *enmagasinement*. Dans tous ces mots, la première *m* représente l'*n* de *en* en composition.

Les réformes acceptées par l'Académie française simplifieraient donc l'orthographe de cent cinquante mots environ, sans compter les changements qui seraient faits conformément aux articles 12 et 13.

Nous avons dit que le rapport de la Commission académique avait été rédigé par M. Emile Faguet. Mais ce rapport n'exprime pas les vues personnelles du rapporteur, dont les conclusions auraient été plus favorables à la réforme. L'éminent académicien s'est expliqué là-dessus dans *la Revue* (1 mars); par exemple, à propos de l'argument tiré de la "physionomie des mots", que présentent la Commission académique et l'Académie, M. Emile Faguet écrit:

"Quant à la physionomie des mots, elle m'est absolument indifférente. C'est l'argument à la portée des simples, des très simples, et c'est pourquoi il est celui dont les journalistes ont abusé et presque le seul dont ils se soient servis. Ils ont du flair. Il est certain que c'est un jeu d'une extrême facilité et d'un effet sûr que d'écrire la phrase suivante: "Je suis home à accepter la nouvèle ortografe avec une satisfaccion sans mélange; car je n'ai pas fait ma rétorique et je ne me conais pas en stile; ma fame non plus". Le lecteur s'écrie, tout fier de son savoir; "Oh! l'orthographe de ma cuisinière!". S'il est plus raffiné, il s'écrie: "C'est peut-être juste; mais c'est affreux c'est horrible! Oh! la physionomie des mots! La beauté des mots! Car le mot a sa beauté!" Et le tour est joué. Seulement la physionomie des mots a changé dix fois depuis trois cents ans, et si l'on s'était arrêté à la physionomie des mots, on écrirait encore *cholère* et *charactère* et *chymie* et *advocat* et *escole* et *abysme* et *argille* et *bienfaicteur* et *déthrôner*...J'ai deux idées sur la physionomie des mots, la première qu'elle m'est indifférente, et que c'est la chose du monde aux changements de quoi l'on s'habitue le plus vite; la seconde, que le mot, si l'on veut, peut être beau ou laid; mais que le mot laid, le mot affreux, c'est le mot surchargé et hérissé, et que le mot beau, c'est le mot simple, sobre, uni et dépouillé, et qu'il en est de la toilette des mots comme de celle des hommes et des femmes."

Plus loin, M. Faguet, parlant en son nom, prend à partie M. Faguet, parlant au nom de l'Académie:

"L'auteur du rapport de la Commission académique triomphe de ce qui si "paon" s'écrivait *pan*, il y aurait une confusion entre

"pan", oiseau, "pan" de mur, "pan", personnage mythologique, et "pan!" onomatopée. Mais, mon ami (il m'est permis de le traiter familièrement), c'est précisément parce qu'il y a déjà trois "pan" entre lesquels on ne fait aucune confusion, qu'il n'y en aura pas davantage entre quatre "pan" ayant quatre sens."

M. Faguet se prononce aussi en faveur de la suppression des lettres doublées: "On reviendra à la prononciation du XVIIème siècle. Je n'y vois que du bien."

La Commission académique ne partageait pas toutes les opinions de M. Faguet, et son *Rapport* n'approuve, on l'a vu, qu'un nombre restreint de réformes.

On pouvait s'attendre que la question serait ensuite portée devant le Conseil supérieur de l'Instruction publique et ferait le sujet d'un arrêté ministériel analogue à celui du 26 février 1901.

En effet, une troisième Commission a été nommée, au mois de juillet 1905. C'est moins une commission d'étude qu'une commission de coordination et de proposition, ayant pour mission de préparer des solutions définitives. Cette Commission est composée de huit membres: MM. Brunot, Clairin, Croiset, Faguet, Gasquet, Hémon, Paul Meyer et Rabier. "La création de cette Commission, dit M. Croiset dans *la Patrie* du 18 juillet, était nécessaire; la première ayant été composée de membres appartenant à l'enseignement, et la seconde de membres de l'Académie, il était naturel qu'elles arrivent à des conclusions différentes, et qu'une nouvelle Commission fût composée de membres de l'Institut et de membres de l'enseignement."

Quoi qu'il en soit, la nouvelle commission n'a pas encore présenté de rapport.

La décision de l'Académie est donc, à cette heure, le dernier acte dont il faille tenir compte dans cette question de la réforme de l'orthographe française.

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SECTION II

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From Isle aux Noix to Chateauguay.

A Study of Military Operations on the frontier of Lower Canada in 1812 and 1813.

PART II, 1813.

By COLONEL E. A. CRUIKSHANK.

(Read May 26, 1914.)

After a war one ought to write not only the history of what has happened, but the history of what was intended; the narrative would then be instructive.—*Von der Goltz.*

During the autumn of 1812 and the early part of the following winter, arrangements were successfully completed by Sir George Prevost for obtaining accurate and constant intelligence respecting the strength and prospective movements of the American forces in the immediate vicinity of the Champlain frontier and for facilitating the importation of provisions, timber and other supplies from the United States in that quarter, which had become a matter of urgent importance. The two principal agents employed in establishing a reliable channel of communication were Leon Lalanne of Montreal and Edward Doyle of Prescott, who entered into a secret understanding for this purpose with several persons residing within the enemy's lines. The most zealous and trustworthy of these agents were Joel Ackley, a land surveyor, living at Plattsburg, having removed to that place from Lower Canada a year or two prior to the declaration of war, and William Price, whose father was a surgeon in the British army. The method proposed by them and ultimately sanctioned for the transmission of information was that they should be permitted to engage in smuggling on an extensive scale as they would thus obtain a pretext for frequently crossing the frontier in either direction without exciting much suspicion.

"They seem to have great hope they would be indulged by the authority of the States," Lalanne reported, "if they were enabled from time to time to get out of this province a small quantity of such goods

as the enemy's troops need and be furnished with some fictitious or real but unimportant information to communicate to the commanding officers of their armies by which means their intercourse with the officers of the troops would be more frequent and intimate and the Customs being thrown off their guard, would render the exchange of information as well as commodities more safe and frequent."[1]

In other words they asked and eventually obtained permission to smuggle goods and act as spies for both belligerents.

Proposals were also received from several persons in the States of New York and Vermont who were willing to enter into contracts to furnish considerable quantities of the most necessary supplies. Inhabitants of the township of Alburg, in the latter state, in particular, offered to supply two thousand fat hogs and two thousand bushels of wheat.[2]

Yet at the same time, the most stringent precautions were deemed necessary to prevent the enemy from securing information by similar means. Lieut. Colonel Pearson, commanding at Prescott, reported that he was sending down to Montreal as a prisoner a man who had been clearly convicted of conducting clandestine correspondence with the Americans, and added:—"Indeed from this to Gananoque, I have but too many whose characters excite much suspicion and whose movements occasion me as much anxiety as those of the enemy."[3]

Having satisfied himself that there was little danger of an invasion of the province for several months at least, Prevost returned to Quebec where he arrived on December 7. Major General de Rottenburg was placed in command of the Montreal District and the important line of communication with Upper Canada as far as Prescott with instructions to forward all available military and naval stores destined for that province as soon as the winter roads became passable by a sufficient fall of snow. Admiral Sir John Borlase Warren had written just before leaving Halifax to take up his winter headquarters at Bermuda, that he would send forward to Quebec guns, sails, and cordage sufficient to arm and equip one of the ships which it was proposed to build on Lake Ontario, and that he would endeavour "to scrape together officers to take charge of her early in the spring." As, however, it seemed more than likely that these officers and stores might arrive so late in the season as to be of little service, urgent demands were addressed to the Secretary for War for guns to arm all vessels under construction and for arms and clothing for

[1] Leon Lalanne to John McGill, Dec. 18, 1812; Edward Doyle to Neil McLean, Nov. 26.

[2] De Rottenburg to Prevost, Dec. 14; Lt. Col. Neil McLean to ——— unaddressed and undated but probably written in December, 1812.

[3] Pearson to Baynes, Dec. 2.

the militia of both provinces. At the same time the Commissary General was directed to contract locally for six thousand suits of clothing to be made of any material he could obtain, as a makeshift.[1]

A tender from John Molson of the steamboat *Accommodation* for the public service in the transportation of troops and light stores between Quebec and Montreal during the next season of navigation was accepted after a successful trial had been made. Another steamboat of equal size had already been laid down in his shipyard at Montreal by the same enterprising builder and was expected to be ready for launching early in the spring.[2]

About the middle of December de Rottenburg reported that Dearborn was still at Burlington, employed in building a large number of sleighs, with the intention, it was surmised, of moving the greater part of his troops toward Upper Canada after the snow fell. He was consequently instructed to reinforce the garrison of Kingston with a bombardier and ten gunners of the Royal Artillery and two companies of the Glengarry Light Infantry which might enable Colonel Vincent to detail a few gunners and one company of the 49th for the protection of York. This insignificant detachment was as large a force as Prevost considered it prudent to spare from the troops allotted for the defence of the Montreal District at that moment. The 103rd Regiment, which had arrived at Quebec in July, although nominally 900 strong, was so largely composed of bad characters and boys, that it was not regarded as fit for service near the frontier. The 1st battalion of the Royal Scots, which had also arrived about the same time, had been stationed for ten years in unhealthy parts of the West Indies, and after landing many of the men were so weak as to be unfit for the lightest duty. Fifty-three foreigners, mainly Frenchmen, were serving in its ranks. One transport, conveying nearly two hundred of this corps, had been taken in the Gulf of St. Lawrence, by the United States frigate Essex and the prisoners sent into Halifax under parole. The remainder, about eight hundred of all ranks, were quartered for two months at Quebec and Point Levi to regain their health before being sent to the seat of war. In September the flank companies were transferred to Montreal and two months later the battalion companies received orders to proceed to St. Jean where they were stationed for the winter.[3]

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[1] Prevost to Sheaffe, Dec. 10; Prevost to Bathurst, Dec. 16; Mil. Secty. to Maj. Gen. Glasgow, Dec; 21, Mil. Secty. to Commy. Gen. Robinson, Dec. 22.

[2] Mil. Secty. to Molson, Dec. 15.

[3] De Rottenburg to Prevost, Dec. 14; Mil. Secty. to de Rottenburg, Dec. 17; Prevost to Sheaffe, Dec. 19; Quebec Mercury, 1812; Cannon, Historical Record of the Royal Scots.

During the last two weeks of December more than one hundred sleigh loads of naval and ordnance stores were successfully forwarded from Montreal to Kingston.[1]

The troops stationed at Prescott, which had become the principal garrison on the line of communication, were provided with snowshoes and exercised in marching with them.[2]

Licenses were granted to a number of persons residing near the frontier to enable them to carry on a clandestine trade with the United States.

Lieut. Colonel Bruyeres, of the Royal Engineers, was instructed to make a thorough inspection and report on the condition of all the military posts and works on the line of communication and along the frontier of Upper Canada as far west as Fort Erie and submit recommendations for strengthening them.[3]

He reported that works of a considerable extent should be constructed immediately at the Cedars, consisting of a blockhouse to be armed with three guns with quarters for two hundred men on the left bank of the river and a second blockhouse and a battery for two guns on Prison Island, nearly opposite, so as to command the navigable channel from both sides. At the River Raisin he found a detachment of one hundred of the Glengarry militia stationed in a miserable temporary barracks. He advised the construction of a blockhouse there for a garrison of two hundred men. One small gunboat had been placed during the autumn at that point for patrol duty in Lake St. Francis. He recommended that two more should be allotted for that service during the coming season of navigation and that two others should be sent to Cornwall for the protection of convoys of boats in the river. Glengarry House was occupied by an officer and thirty militiamen who were actively engaged in barricading its windows and doors. He proposed the construction there of a battery for four guns. It was reported and believed that the enemy were building a number of large boats in the Salmon River and cutting a road towards St. Regis with the intention of establishing a military post near that village.

Cornwall was garrisoned by 140 men of the Stormont militia, commanded by Colonel Neil McLean. They were quartered in the courthouse, which afforded miserable shelter. As no good position could be found in the vicinity, he did not consider the construction of any fortifications advisable but directed that the blockhouse already built by the militia in the township of Osnabruck, a few

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[1] Prevost to Sheaffe, January 1, 1813.

[2] Mil. Secty. to Vincent, Jany. 3.

[3] Bruyeres to Mil. Secty., Jany. 7.

miles higher up the river, should be strengthened with abatis and another post established at Point Iroquois.

He considered Prescott a very good military position which required immediate attention by closing the gorge of the existing battery and the construction of a large blockhouse. Ogdensburg directly opposite, was occupied by Major Forsyth's command of United States Rifles, and a company of volunteer artillery, with some local militia, estimated to number in all about 230 men. This force could be easily dislodged, but an attack at that season of the year was not considered advisable as the enemy's armed schooners and gunboats were fast in the ice and could not be brought off as prizes and success would probably provoke retaliation by the enemy who could easily assemble a large force of militia for a short period of service. Lieut. Colonel Pearson quite concurred in this opinion. Several deserters from Ogdensburg had recently arrived at Prescott and agreed in stating that Forsyth had made himself extremely unpopular by his tyrannical conduct and his men were very discontented.

Brockville, the most populous village between Montreal and Kingston, was occupied by a rifle company and a battalion company of the Leeds militia. They were undisciplined and inefficient, a large number of the men being absent without leave at their homes. At Gananoque, another company of the same regiment was building a blockhouse under the supervision of Colonel Joel Stone.[1]

Positive information of a movement of troops in sleighs from the borders of Lake Champlain in the direction of Ogdensburg induced Prevost to strengthen the garrisons on the line of communication by some weak detachments from Montreal, and to replace these, Sir John Sherbrooke was directed to despatch six companies of the 104th Regiment and a small party of Royal Artillery from New Brunswick to Quebec by the little travelled, overland post-route. De Rottenburg was at the same time authorized to recruit eighty drivers for the Royal Artillery. The Canadian Voltigeurs had been easily completed to their full establishment with volunteers of an excellent character and four companies of that corps were detailed for service in Upper Canada.[2]

Early in February, Colonel Neil McLean received a disquieting report from an officer sent in charge of a flag of truce to pay claims for losses sustained by inhabitants of the French Mills on the Salmon River, that a body of regular troops had arrived there and he had been told that a large body of volunteers was being organized

[1] Bruyeres to Prevost, January 14 and 19, 1813.

[2] Mil. Secty. to de Rottenburg, Jany. 2; C. M. de Salaberry to L. de Salaberry Jany. 29; Prevost to Torrens, March 18.

in Vermont for the purpose of making a raid upon Cornwall and permanently interrupting the communications between the provinces.

In consequence of this intelligence, de Rottenburg considered it prudent to delay a train of forty sleighs loaded with heavy guns and valuable stores until the militia of the adjacent counties could be assembled in force to act as an escort. The wisdom of his decision was almost immediately justified by a successful attack upon Brockville on the night of February 6-7.

Several deserters from the regulars and militia had made their escape to the American side, and on the night of February 4, a small armed party from Prescott crossed the river and apprehended some of these men who were committed for safe keeping to the district jail at Brockville. During the absence of General Brown the command of the garrison at Ogdensburg devolved upon Captain Forsyth, who had already planned an attack upon Prescott which he had been unable to execute. The capture of these deserters furnished him with a sufficient excuse for a raid upon Brockville, which he had ascertained to be occupied by a small force of very inefficient militia. During the night of February 6-7, he rapidly conveyed two hundred men from Ogdensburg to Morristown in sleighs and crossed on the ice, taking the precaution to leave a party with a fieldpiece near the middle of the river in a position to cover his retreat in the event of being repulsed. Owing to the inexcusable negligence of the officer in command, he succeeded in surrounding the village before daylight without being observed. The only sign of resistance was offered by a sentry who fired a single shot and wounded one man. In retaliation the invaders fired volleys into every house where a light was seen without injuring a person. Captain Stuart who commanded the flank company was surprised in his sleep with several of his men. Major Carley, Captain Jones, Ensign Morris with about twenty privates of the embodied militia were taken prisoners, besides a number of unarmed inhabitants who were doubtless also enrolled and liable to military service, swelling the number to fifty-two. All persons confined in the jail with the exception of a man named Irving, charged with murder, but including no less than sixteen deserters, were liberated and taken off. The building occupied as a barracks was burned. Twenty rifles, thirty-one serviceable, and forty-seven unserviceable muskets with a quantity of cartridges were carried away. No other public stores could be found.

As the place was considered of little consequence from a military point of view, there being no regular officer to take command and the distance from Prescott too great to admit of effective support, Pearson decided not to re-occupy it except by the resident seden-

tary militia. He again reported his opinion that the capture of Ogdensburg might be easily effected if he were reinforced with two hundred men.[1]

On the following night, Captain Richard Duncan Fraser of the 2nd Grenville Militia, crossed with a scouting party of Indians a couple of miles above Ogdensburg and carried off the sentry of an outlying piquet, causing considerable alarm. This incident combined with a movement of troops to Prescott from the posts below, induced Forsyth to call in an entire regiment of militia from the surrounding country which increased his force within a few days to more than eight hundred. His successful raid upon Brockville greatly enhanced his reputation as an enterprising officer and was eventually rewarded by promotion. The batteries at Ogdensburg were put in order and strengthened and all arms in store at the neighbouring villages as far away as the French Mills were called in to arm the local militia. "Should an attempt be made," an officer wrote, "I have the highest confidence in our success. Indeed from the high tone of the troops, it is difficult to restrain their ardour, and, should they not be attacked from the other side in a few days, I should not be surprised if they were to go over there."[2] Two or three nights later, Lieut. Beard actually made another incursion into Canada and carried off three men from an isolated farm with a valuable team of horses. Major Macdonnel who was sent to Ogdensburg by Pearson to remonstrate against this form of "predatory warfare," was treated with such marked discourtesy that he returned in a very indignant frame of mind. However, the American militia assembled there soon became discontented and began to return to their homes without leave, on which Forsyth applied to General Dearborn for a reinforcement of regular troops. He was informed that none could be sent him for some weeks but he might abandon the post if his present force was not considered sufficient to maintain it. A council of war was then assembled which decided to remain and make every possible preparation for defence. The movement of four companies of the 8th Regiment and a small party of seamen from Montreal to Kingston by successive detachments, which was observed and duly reported from various stations on the river below, kept Forsyth on the alert for ten days, after which his vigilance seems to have relaxed.

The legislature of Lower Canada assembled for its regular session on December 29. After reviewing the events of the war in a pardonably complacent tone, the Governor General thanked the members

[1] Colonel L. P. Sherwood to Pearson, Feby. 7; Pearson to de Rottenburg, Feby. 7; Quebec Mercury, 1813; Hough, Hist. St. Lawrence County.

[2] Letter in the Federal Republican of Feby. 23, 1813, dated Ogdensburg, Feby. 10.

in the name of the Prince Regent for their assurances of attachment and support in reply to his speech at the opening of the preceding session and added that "His Royal Highness placed that confidence in the courage and loyalty of His Majesty's Canadian subjects which made him equally fearless of the result of any direct attack upon them and of any insidious attempts to alienate their affections from his government." In accordance with powers previously vested in him by the legislature he had called out the militia to assist in the defence of the province and "with the most cheering satisfaction had been a witness of that public spirit, that steady order, and that love of their country, their religion, and their laws which they had manifested on that occasion and which by animating and uniting all classes of His Majesty's subjects, could not fail, under Divine Providence, to make them safe at home and respected abroad."

He remarked that the great benefits derived to the public service from the operation of the Army Bills Act were apparent and recommended it to their consideration for renewal and extension. A careful revision and amendment of the militia law was also expedient and he again intimated that it might become necessary to resort to martial law in an emergency and asked their approval. The speedy transaction of business was strongly urged.

The address from the Assembly in reply said:—

"We feel it incumbent on us to state to Your Excellency that not only that part of His Majesty's subjects who have been placed in your immediate view but the entire population of the country, are devoted to the cause and will cheerfully make every sacrifice which the safety of their country and its future happiness may require at this truly important and critical conjuncture, thereby assuring to themselves a superior claim to the confidence and affection of their beloved sovereign." They declared their satisfaction that the campaign had ended "without the effusion of blood, without loss of territory, and without interruption to the most important habits of peace by recourse to martial law. To the energetic yet mild and conciliatory measures of Your Excellency and to the devotion of His Majesty's Canadian subjects, we ascribe that happy and honourable termination."

Prevost affably assured them that their sentiments were worthy of the representatives of a loyal, brave, and enlightened people.

Since his arrival in the province he had in fact made most strenuous efforts to promote internal harmony and conciliate those members of the legislative assembly who had been actively hostile to his predecessor. This was observed with considerable annoyance by influential members of the English party. John Blackwood informed a correspondent that "our Governor seems to be trying rather a

singular experiment. All the people who were during the late Sir James Craig's administration dismissed by him from their situations as militia officers or justices of the peace or were at different times confined by a warrant from a Committee of the Executive Council under a suspicion of treasonable practices, are reinstated in their former situations with new honours and places of trust and responsibility and profit conferred on them, the best he could give. How this will answer, time will show."[1]

It soon became apparent that the session would not be allowed to pass without some display of bitter partisan feeling. James Stuart, who had been dismissed by Sir James Craig from the post of Solicitor General, assumed the position of leader of the opposition and distinguished himself by rancorous criticism. He first moved for the appointment of a committee to enquire into the causes and injurious consequences that might have resulted from the delay in publication of the acts of the provincial legislature passed at the February session of 1812. The evident intention of this enquiry was to extenuate the conduct of the Lachine rioters and to discredit and embarrass the government. The clerk and other officers of the Legislative Council were summoned to appear as witnesses before the Committee to which the Council at first refused their consent as they had not been previously consulted, but subsequently reconsidered their action and gave permission for the appearance of their officers under protest as they desired to abstain from raising any question that might delay the consideration of the necessary measures for the defence of the province. This investigation had no result of any consequence. Stuart next moved for an enquiry into the power and authority exercised by the Courts of Law under the title of Rules of Practice; but the committee appointed made little progress before prorogation. Some important amendments to the militia acts which were adopted by the Assembly, were rejected by the Legislative Council and the whole measure failed to become law in consequence. The Army Bill Act was renewed and extended to legalize the circulation of notes to a total amount of half a million of pounds and a board of commissioners was appointed with authority to fix the current rate of exchange at regular intervals. Twenty-five thousand pounds were voted towards defraying the expenses of the war, fifteen thousand pounds for the equipment of the embodied militia, one thousand pounds for militia hospitals and four hundred pounds to improve the communication with Upper Canada. A duty of two and one half per cent was imposed upon all articles of merchandise, except provisions, imported into the province and a special duty of five per cent upon all merchandise imported by persons who had resided

[1] John Blackwood to Todhunter, Wyndham & Co., Montreal, Oct. 17, 1812.

therein less than six months, was also earmarked for the prosecution of the war. Intelligence of the victory at the River Raisin was received on the 8th of February and the Assembly promptly passed a vote of thanks to Colonel Procter for his skill and gallantry on that occasion and a second vote of thanks to the officers, non-commissioned officers and privates of the line, marine, and militia engaged in the action.

On a motion by Mr. Stuart that part of the Governor General's speech relating to martial law was referred to a special committee, which presented the following unsatisfactory report:—

"Resolved that it is the opinion of this Committee that Martial Law and the power of declaring and executing it are known in the laws of this Province only in *so far* as they are recognized in the constitutional or public law of England which has been introduced into this Province.

"Resolved that it is the opinion of this Committee that according to the constitutional or public law of England making part of the laws of this Province, Martial Law in the cases in which it may be lawfully declared and executed in respect of His Majesty's subjects *hath been and is limited in its operations to military persons.*

"Resolved that it is the opinion of this Committee that all occasion or pretence for recurring in this Province to Martial Law in the sense in which it is understood in the constitutional or public law of England *hath been taken away* by the act of Parliament of the United Kingdom of Great Britain and Ireland, entitled 'an act for the punishment of mutiny and desertion and for the better payment of the Army in their quarters,' by the 'Rules and Articles for the better government of His Majesty's Forces,' and by the Militia Laws of this Province whereby the Executive Government has become and is vested with *all* the powers *necessary* to provide for the safety of this Province in the present conjuncture.

"Resolved that it is the opinion of this Committee that the limits and operation of Martial Law as above stated *could not nor cannot be* legally *enlarged* in this Province *without* the authority of the Provincial Parliament."

The report of the Committee was eventually adopted by the Assembly on a division by a vote of eighteen to fifteen on the 13th of February.

Rather alarming reports of the increased activity of the enemy at Ogdensburg and the extensive preparations they appeared to be making elsewhere for carrying winter operations against Upper Canada, combined with the ill health of General Sheaffe which had disabled him from transacting any business for several weeks and the slow progress made in ship building at York, decided Prevost to under-

take a journey to that province as soon as the prorogation of the legislature would permit him to leave Quebec. Colonel Vincent was transferred from Kingston to command the troops on the Niagara frontier and replaced by Lieut. Colonel Pearson who was succeeded at Prescott by Major Macdonell of the Glengarry Light Infantry. Each of these officers was granted a temporary step in rank. Four companies of the 8th Regiment were ordered from Montreal to Kingston and eight heavy guns were forwarded from Quebec to arm the works in progress at Prescott, Kingston and York. Eighteen carronades were purchased from a merchant as a temporary armament for the ship under construction at Kingston. Eighty seamen for lake service had been enlisted and sent forward. About nine hundred of the embodied militia would become entitled to their discharge in June and a draft of 2,200 from the sedentary force to replace them was ordered in March. This would increase the five battalions already formed to a strength of 4,000 of all ranks. Clothing of an inferior quality had been purchased for them and two thousand of the militia of Upper Canada by the Commissary General from merchants at Quebec and Montreal.

The session of the legislature had already continued at least a week longer than the Governor General had anticipated and some members of the opposition seemed inclined to prolong it. He accordingly announced his intention of proroguing the House of Assembly on the 15th, stating that his presence was most urgently required in the upper province. No trace of the annoyance and disappointment which he must naturally have felt respecting the failure of the amendments to the militia act so strongly desired by him and the passage of their ill advised resolutions with regard to martial law, was apparent in his speech. He thanked the Assembly warmly for their liberality in granting supplies for the public service. "The present crisis," he added, "will in all probabliity, call for sacrifices which your loyalty and patriotism will, I trust, lead you without hesitation to make. And I look forward from your good example to a cheerful acquiescence on the part of all His Majesty's subjects in the province, in whatever may be required of them for the defence of the country and for the preservation of the blessings they enjoy under His Majesty's mild and paternal government."

On February 17, he began his long and tedious journey in bitterly cold weather and travelled as continuously and with as much speed as the great depth of snow would permit, arriving at Montreal on the 20th and at Prescott on the following evening. Two companies of the 8th Regiment commanded by Captain Eustace had arrived there that morning on their way to Kingston and both Pearson

and Macdonell concurred in the opinion that this would be an opportune time for an attack on Ogdensburg. They had carefully reconnoitered its defences and ascertained that its garrison had been diminished by desertions and other casualties to less than five hundred, of whom more than half were regular troops. The troops assembled at Prescott then consisted of a non-commissioned officer's party of the Royal Artillery, one company of the Glengarry Light Infantry, fifty men of the Royal Newfoundland Regiment, and the flank companies of the 1st Glengarry, Stormont, Dundas, and 1st and 2nd regiments of Grenville militia. With this force and the two strong companies of the 8th, success seemed more than probable. Yet the Governor General hesitated to sanction the enterprise as he was extremely unwilling to intensify the spirit of hostility by assuming the offensive. During the night, however, two soldiers deserted and as his personal escort was small, he gave reluctant permission to Macdonell, to whom Pearson had transferred the command, to make a demonstration with discretion to convert it into a real attack if he thought proper. Prevost accompanied by Pearson set off for Kingston before daybreak and all the troops at Prescott were at once placed under arms. Having detailed a small force to occupy the batteries, Macdonell formed the remainder into two columns on the ice-bound river in front. The right column, commanded by Captain Jenkins of the Glengarry Light Infantry, was composed of his own flank company of that corps, supported by seventy militia, numbering in all one hundred and twenty of all ranks, with a field piece, was directed to attack the batteries on the right bank of the Oswegatchie river near the lighthouse and the stone barracks on site of the old French fort, which were occupied by Forsyth's riflemen. This movement threatened the enemy's line of retreat to Black River and Sackett's Harbour. With the left column, composed of one hundred and twenty men of the 8th, forty of the Royal Newfoundland, and two hundred militia supported by two field pieces mounted on sleds, Macdonell proposed to deliver the main attack on two redan batteries and a timber breastwork directly in front of the town on the left bank of the Oswegatchie and an unfinished quadrangular redoubt, called Fort Oswegatchie, where the main body of the American troops was usually stationed. He had lately obtained a good view of these defenses and now intended to turn them by their right flank and thus escape the fire of most of their guns. Before the order for the advance was given the fervour of the Scottish militia of Glengarry and Stormont was raised to a high pitch by a stirring address from their patriotic parish priest, the Reverend Alexander Macdonnell. As the river at this point is more than a mile in width and the garrison of Prescott

had been frequently paraded and exercised on the ice in the early morning their first movements attracted little attention until the two columns were quite halfway across and seen to be steadily advancing toward the American shore. The sentries hastily gave the alarm and the works were manned with every sign of haste and confusion. Before they could open fire the British columns had separated, each of them moving as rapidly as the snow drifts would permit and extending into skirmishing order as it advanced. The guns were unable to keep up and finally stuck fast in the snow. As they approached the American shore and gained the shelter of the high banks, the infantry swiftly closed without any word of command, and after a brief halt under cover to regain their breath, rushed directly upon the nearest batteries. The town was occupied by three small companies of volunteer artillery and a weak battalion of militia infantry. The advance party of the left column, bravely led by Staff Adjutant Ridge accompanied by a few gunners of the Royal Artillery under Bombardier Anderson, who had abandoned their own gun in a snow drift and were armed only with their rammers, carried the eastern battery without firing a shot, taking two officers and thirteen privates and capturing three field pieces which were immediately turned against the remaining defences of the town. The timber breastwork and a small redan battery, being thus turned and taken in reverse by this fire, were soon abandoned by their occupants with two more guns. Fort Oswegatchie was next taken after a feeble resistance, its garrison retiring to the arsenal, a substantial stone building on a commanding site near the eastern end of the bridge over the Oswegatchie river, where they made a determined stand supported by another field piece which was actively served. This gun was eventually taken with the officer in command and several wounded men after a fierce struggle in which three Canadian militia officers were wounded. A portion of the American militia retreated across the bridge but the majority sought shelter in the woods or in buildings on the same side of the frozen stream whence they maintained such a galling and annoying fire that it was ultimately found necessary to bring forward several field guns by hand to dislodge them.

Meanwhile the column under Jenkins had encountered a most stubborn resistance from Forsyth's riflemen and small detachments of artillery and the 21st United States Infantry holding the batteries near the mouth of the Oswegatchie and the stone barracks of La Presentation. It was exposed for several minutes to the fire of seven guns and the musketry of two hundred men at close range while struggling through the deep snow. After resting for a moment under the shelter of the bank, Jenkins led a charge in person against the battery

at the lighthouse but had only advanced a few paces when his left arm was shattered from the wrist nearly to the shoulder by grape shot. He still continued to move onward and encourage his men in spite of the terrible pain caused by the splintered bones rubbing against his sword belt and side until another shot tore much of the flesh from his right arm. Nearly overcome by agony he tried to stagger forward but reeled about until finally he fell insensible on the snow. The command of his flank company devolved upon Lieut. Macaulay, a young officer of great merit, who continued to lead the charge until a further advance became plainly hopeless from the severe loss and evident numerical superiority of the enemy. At this moment some of the leading men were so near the battery that they were unable to retire and were taken prisoners. Another small party seized and retained possession of a commanding knoll from which they opened a brisk fire. The militia, however, had fallen behind and failed to support the assault with effect.

Having subdued all resistance on the outskirts of the town, Macdonell's column reassembled on the high ground on the right bank of the Oswegatchie opposite the fort and barracks of La Presentation. The officers and men were greatly exhausted by their previous exertions. With the object undoubtedly of gaining time and to restore order and give them rest, a flag of truce was sent over to demand an unconditional surrender of the works still held by the enemy. This was as a matter of course met by a refusal but Forsyth immediately took the precaution to retire from the fort with the majority of his riflemen and the only field piece left in his possession. He took up a position at some distance on a ridge commanding the bridge and covering the road which formed his line of retreat. The nearest battery was then taken with little trouble and its guns turned against the stone barracks with such effect that both American officers commanding gun detachments there were disabled. Captain Eustace at the head of the detachment of the 8th and a Highland company of militia carried the building at the point of the bayonet, most of its defenders escaping by the rear gate, but leaving a wounded officer and several men behind as prisoners. Forsyth quickly retired into the woods by the road leading to Black Lake, taking with him one field piece mounted on a sled carriage. Further pursuit seemed inexpedient and was probably impracticable owing to the exhausted condition of the troops. The prolonged and heavy cannonade was heard by Prevost's party on the road and excited so much apprehension in his mind that he despatched a hasty message from Flint's tavern, cancelling the permission he had granted for an attack which fortunately was not delivered to Macdonell until the termination of the action.

Great exertions were immediately made to remove the captured stores of which there was an unexpectedly large quantity. Four brass and seven iron guns with a large supply of round shot, 673 stand of small arms, twelve barrels of powder and fourteen kegs of ball cartridges were brought away with the colours of a regiment of New York militia and the garrison flag. Five iron guns, lying on the wharf without carriages were rendered unserviceable. The prisoners, mainly militia, numbered seventy-four, of whom four were officers. Fifteen hundred barrels of provisions were discovered in store in the public and private warehouses, of which only a small part could be removed at once from want of transport. Two capacious ranges of barracks, the armed schooners *Dolphin* and *Niagara* and two gunboats of the row-galley type, were burned. The place was evacuated before dark.[1] Macdonnell's total loss was fifty-six killed and wounded or about twelve per cent of the force engaged.

Forsyth retreated nine miles to Black Lake that day and thence to Sackett's Harbour. Macdonnell followed up his success by a requisition for the delivery of all surplus provisions, flour and wheat remaining in the hands of the inhabitants, offering to pay them the full market price and promising protection and security from invasion in future providing that the town of Ogdensburg was not again occupied as a military post, as he declared that complete satisfaction had at length been obtained by force of arms for all depredations committed on the Canadian side. Many of the people had already deserted their homes but those who remained were naturally quite willing to comply with so reasonable a demand.[2]

The expulsion of the sole remaining American garrison on the St. Lawrence secured the line of communication from any immediate danger of interruption and enabled the British commissary officers to draw considerable supplies of provisions and forage from hostile territory for the subsistence of the troops at Prescott, Cornwall, Montreal and its dependencies. The result of the action became known at Kingston next day and at Montreal on the 24th and was made the subject of congratulatory orders in both districts. Guns and stores of all kinds were forwarded as quickly as possible to Upper Canada while the sleighing lasted.

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[1] Macdonell to Harvey, Feby. 22, 3 p.m.; Macdonell to Baynes, Feby. 2; Returns of casualties and captured stores; Forsyth to Macomb, Feby. 22; Macomb to Dearborn, Feby. 23; Dearborn to Secretary of War, Feby. 25; Letter in New York Gazette, Mch. 2, to Senator H. H. Atwater from his son dated Feby. 27; Letter in Poulson's Daily American Advertiser, dated Feby. 27; General Orders, Kingston, Feby. 23, and Montreal, Feby. 25.

[2] Letter in New York Gazette, Mch. 9.

Some delay in the construction of the vessels undertaken at Kingston had been caused by discontent among the workmen which led to dismissal of two master builders in succession, but the new ship had been completely planked and the necessary alterations made to the *Moira*. Prevost was presented with an address from the principal inhabitants and a proposed expedition against Sackett's Harbour apparently became the subject of serious discussion with the deputation, as a report soon became current that he had given the assurance that he would destroy the American squadron lying in that port or perish in the attempt. It was duly transmitted to Commodore Chauncey who took every precaution to repel an attack.[1]

On reaching York, Prevost learned that Sheaffe had sufficiently recovered to resume his civil duties but that very little progress had been made in the dockyard owing to want of system and judgment on the part of the builder. He continued his journey in a few hours to Niagara where he arrived on February 27. After making a rapid inspection of the defences along that frontier, he returned to York, where he was presented with an address from the magistrates and other inhabitants in which they thanked him for the "vigorous exertions which had been made and are still carrying on towards the strengthening of the Provincial Marine, fully convinced that to maintain a superiority on the lakes is an object of the first importance to this province."[2]

Prevost returned to Kingston on Friday, March 5. Next morning he inspected the garrison and fortifications of the town and Point Frederick. He was then presented with a second address from the principal residents, several of whom were entertained by him at dinner in the evening. At daybreak on Sunday, March 7, he resumed his journey, having evidently abandoned any intention he might have entertained of making an attack upon Sackett's Harbour. At Prescott, he learned that Major Macdonell was still disabled by a wound he had received in the recent action and the Adjutant General was directed to remain there for a week to superintend the necessary arrangements for the defence of that post and the line of communication.[3]

When the Governor General reached Montreal on the evening of March 9, belated despatches, brought from England by the November and December mail packets, were delivered to him, containing the welcome information that the 13th and 98th Regiments and the 2nd battalion of 41st were under orders to sail for Quebec and that the 64th Regiment would be sent from the West Indies to Halifax, while

[1] Chauncey to the Secretary of the Navy, Mch. 5.

[2] Address from the magistrates and other inhabitants of York, Mch. 3.

[3] Military Secretary to Sheaffe, Mch. 10.

a strong division of seamen with a due proportion of officers of the Royal Navy, detailed for service on the lakes, would sail in time to arrive in the St. Lawrence as soon as that river was clear of ice.

The remainder of the 8th Regiment, then assembled at Montreal, under the command of Major Cotton, was at once ordered to march to Upper Canada. Two companies were to remain at Prescott and six to join the garrison of Kingston which would then consist, in addition to these, of five companies of the Glengarry Light Infantry, three companies of the Newfoundland regiment and eight or ten flank companies of local militia. This force, it was thought, would be ample to defend that place from any attack until the seamen arrived. Two companies of the Glengarry regiment were to march from Kingston to York and enable Sheaffe to augment the force at Amherstburg to six companies of the 41st. An officer of the Royal Artillery with a sleigh load of gunners was also sent to Prescott with instructions to put the batteries in order and return to Montreal, leaving the men behind. Four companies of the Canadian Voltigeurs under Major Heriot were placed under marching orders for Upper Canada, where they would be quartered at Kingston or moved forward to Niagara as circumstances might dictate, as a practical evidence that the young men of Lower Canada were willing to participate in the defence of the sister province, whose militia had already been sorely tried by the losses, hardships, and privations of long continued service in the field.[1]

Prevost remained but two days at Montreal and then hurried back to Quebec, where he arrived on the 16th, having been absent only twenty-seven days. He was then able to report the safe arrival of six companies of the 104th, overland from New Brunswick, numbering nearly six hundred effectives, a few of whom were suffering from frostbite sustained in their arduous march. Two companies had been left behind in New Brunswick and two others in the islands of Cape Breton and Prince Edward.[2]

The leading company had started from Fredericton on the 16th of February, followed by another every successive day until the 21st. Twenty-four days later they arrived at Quebec in the same order, having traversed a distance estimated at 361 miles. Between Fredericton and the Grand Falls, they were transported in the sleighs of the inhabitants along their route who turned out with great alacrity to convey them from stage to stage over the level road furnished by the frozen surface of the river. At the latter place the settlements in New Brunswick ended and the actual march on foot began. A trail follow-

[1] Military Secretary to Sheaffe, Mch. 11; Prevost to Bathurst, Mch. 19.

[2] Prevost to Bathurst, Mch. 17.

ing the St. John and its tributary stream, the Madawaska, to Lake Temiscouata and thence to the French Canadian settlements at Kamouraska had been roughly cut through the unbroken forest by command of General Haldimand thirty years before and during the winter months the English mail from Halifax to Quebec was carried by this route whenever it had been deemed unsafe to send it by way of New York. Couriers travelled it each way once a fortnight in summer and once a month in winter. Lieut. Colonel Harvey, who had arrived at Halifax, being anxious to assume his duties as a deputy-adjutant-general in Canada without delay, had made the journey without much difficulty in the latter part of that month and the first week in January. He reported it practicable for the movement of troops when the rivers and lakes were frozen, although the trail was much obstructed by fallen timber and the growth of underbrush. Soon after his arrival at Quebec, an officer of the Quartermaster General's department was instructed to go over it, make the necessary arrangements for the march, and act as guide.[1]

Every man was equipped with moccasins, snow shoes and a pair of warm blankets. As most of them were natives of New Brunswick they were generally skilful axemen and able to build huts for themselves with evergreen boughs. Each file was provided with a toboggan on which they were required to draw their arms, accoutrements, blankets and fourteen days' provisions, each day's rations consisting of a pound of meat and ten ounces of hard biscuit. Several three pounders mounted on sleds with a supply of ammunition, drawn by a detachment of Royal Artillery, accompanied the column. More snow had fallen than at any time in the preceding nine winters and it lay seven or eight inches deep on the level. On March 1, the leading company arrived at Grand Falls. The next two days' march was made over a fairly level trail along the river bank, after which the frozen surface of the St. John and Madawaska and Lake Temiscouata, except where the course of the rivers was broken by rapids or falls, furnished a good marching road for almost two hundred miles. The companies invariably marched in single file and every officer and man was required to take his turn in leading the way and breaking a path for the same length of time, when he fell to the rear. The march generally began at daybreak and lasted until the middle of the afternoon when a camp was formed in a sheltered spot in the woods.

The best axemen were set to felling pine trees to form rafters for the huts; these were trimmed of all lateral branches and cut to fifteen feet. Others trimmed branches and thatched the roof or threw back the snow with their shoes till they came to the soil, four or five

[1] Sherbrooke to Prevost, Dec. 14, 1812; Prevost to Sherbrooke, Jany. 27, 1813.

feet below, and formed a high wall around the huts to shelter them from the cutting wind. The thermometer constantly stood at from 15 to 27 below zero and water was immediately frozen inside the huts while the fires were burning.

"On the fourth of March ," wrote an officer, "the cold was increasing and an incessant snow storm filling our tracks rapidly. We had to leave the Madawaska river owing to the rapids, and the thickness of the brush and the forest made the march tedious. On the 5th, the cold greatly augmented, and a heavy gale blowing in our faces hardly left us power to breathe. About midday the company halted and hastening forward I discovered that every man was more or less frostbitten."

Armstrong's company which had that day set out to cross Lake Temiscouata was driven back by the fury of the storm and returned to the huts they had left in the morning where Shore's company was due to arrive before night. Their stock of provisions had been entirely exhausted and they would have been obliged to march without food all next day had not Lieutenant Charles Rainsford and Privates Gay and Patrick nobly volunteered to make their way to the nearest settlement and return with a supply. This they successfully accomplished, performing a wearisome journey of forty miles in a terrific storm within twenty-four hours without sleep and with very little rest, dragging their toboggans all the way.

The entire detachment was inspected by the Governor General at Quebec on March 25 and a few days later the flank companies were ordered to proceed to Kingston where they arrived on April 12, having travelled 760 miles in fifty-six days.

While at Montreal Prevost had been supplied by Captain Gray with a comparative statement of the opposing forces on the lakes upon the opening of navigation compiled from the best information that was obtainable, from which it appeared that if all the vessels under construction on either side were launched and fully armed, equipped and manned, the British squadron on Lake Ontario would be superior in the apparent proportion of three to two, but the number of officers and men expected from England would be barely sufficient to man them and there would be no margin for the replacement of casualties or for manning the squadron on Lake Erie where an equal preponderance in ships and guns was confidently anticipated. He consequently urged the Colonial Secretary in the strongest manner to increase the number sufficiently to ensure a superiority on both lakes "so essentially necessary for the defence of Upper Canada."[1]

[1] Prevost to Bathurst, No. 50, Mch. 19.

Gray was again ordered to go to Kingston and give Lieut. Colonel Pearson every possible assistance in concentrating the naval force on Lake Ontario at that port as soon as navigation opened.[1] Under the supervision of these energetic officers rapid progress was made both in naval construction and fortification. A schooner and two gunboats were laid down, batteries and blockhouses completed, furnaces built for heating shot, and semaphore telegraphs established at lookout stations and in the forts. The *Royal George* and *Moira* were moored within pistol shot of the town under cover of the main batteries and a blockhouse, and a channel twelve feet in width cut all round them and kept constantly open as a protection against surprise. Soldiers and sailors were constantly exercised at the guns and before the end of March Pearson felt justified in reporting that he was "in perfect readiness to resist any attempt the enemy might be induced to make against this post."[2]

On the other hand the officer in charge of the navy yard at York angrily reported that from the lack of system and capacity on the part of the builder, "who evades or disobeys all orders given him," there was little prospect of the ship on the stocks at that place being launched before the first of June.[3]

Orders were given for the organization of a provincial marine corps for service on board the gunboats employed on the St. Lawrence and Richelieu rivers within the district of Montreal to consist of eight lieutenants, eight boatswains and 156 men besides eight gunners attached from the Royal Artillery. The first division composed of one small and two large row galleys was stationed at Isle aux Noix, the second division consisted of two large galleys stationed at the mouth of the River Raisin and one small galley at Cornwall; the third division of two large boats was stationed at Lachine. The men of this corps were enlisted for eighteen months or during the war if it lasted longer.[4]

Thomas Coleman, a prosperous draper of Montreal, had succeeded in organizing a troop of dragoons, which speedily attained such efficiency that it was detailed for active service in Upper Canada.

The strength of the detachment of Royal Artillery stationed in both provinces was four companies with only thirty drivers, which was far from being adequate to the duties required of them. The want of trained gunners and drivers was particularly felt although a small

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[1] Mil. Secty. to Pearson, Mch. 23.

[2] Pearson to Mil. Secty. Mch. 18 and 29; Capt. J. B. Irwin to Mil. Secty. Mch. 29; Chauncey to Secty. of the Navy, Feby. 21.

[3] Myers to Mil. Secty., Apr. 2; Major Clerk to Gray, Mch. 24; Gray to Mil. Secty., Apr. 18.

[4] Memo by Captain G. A. Eliot, Apr. 21.

reinforcement had arrived from England since the declaration of war and one company had been transferred from Halifax to Quebec. The drafts received had been barely sufficient to replace casualties and the fortress batteries could only be manned with the assistance of men from the line and militia while the field guns had not more than half the necessary complement of regular artillerymen. During the past summer the garrison of Quebec had included only one weak company of about fifty men while at least three strong companies were needed to man the batteries properly. The entire strength of the corps in both provinces was 585 of all ranks besides a drivers' corps of 144. Six brigades had been already organized for field service in the Montreal District and Upper Canada for which alone 396 gunners and 294 drivers were required. Three additional companies were urgently wanted besides detachments of artificers and gunner-drivers.[1]

It was accordingly decided to enlist two companies of provincial artillery drivers, one in each province, to consist of two officers, ten non-commissioned officers, and eighty gunners to serve for three years or during the war, and one company of artificers in Upper Canada to consist of one officer, three sergeants and fifty privates.

On the part of the Americans, Lieut. Macdonough was actively engaged during the winter and early spring in fitting out the vessels in Basin Harbour near Shelburne. The quarter-decks were removed from the sloops *Eagle* and *Growler*, thus permitting their armament to be increased to eleven guns each, but he was precluded from appearing on the lake for several weeks after the opening of navigation from want of a sufficient number of trained seamen to man them. At the end of January, he reported that he had only twenty seamen and modestly asked for thirty more. "There are no men to get here," he wrote, "and soldiers are miserable creatures on shipboard, and I very much fear that unless I get the above (ordinary) seamen and not soldiers, there will be a dark spot in our Navy."[2] These seamen with a dozen shipwrights were sent on from New York about a month later. Twenty iron 18 pounder carronades lately forming the armament of British sloop of war Alert taken by the frigate Essex, but condemned as unfit for service, were forwarded from Boston to make up his complement of guns.

He had learned that many cattle and considerable quantities of provision and grain for the supply of the British troops had been taken into Canada from Vermont, generally crossing the boundary

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[1] Major General Glasgow to Prevost, Dec. 18 and 22, 1912.

[2] Macdonough to the Secretary of the Navy, Jany. 22.

after dark. When navigation opened it was reported that rafts of timber and spars were being taken to Isle aux Noix.[1]

On the 1st of May all the American armed vessels were moved to Plattsburg, where the gunboats were laid up and their crews transferred to the sloops with the intention of putting a stop to further smuggling by water. A month later, Lieut. Sidney Smith was placed in command of these vessels, whose crews were increased to an aggregate of 112 of all ranks by thirty-three volunteers from the regular infantry and he was instructed to blockade the entrance of the Richelieu with the double purpose of preventing boats and rafts from reaching Isle aux Noix and the British gunboats at that post from entering the lake. At dark on the evening of June 2, the two sloops anchored near Rouse's Point. Shortly after daybreak, next morning, Lieut. Smith signalled the officer in command of the Eagle to get under way and follow his vessel into the river. The pilot of the Eagle protested warmly against this movement saying that if he once entered the river with the wind blowing as freshly from the south as it was then, he would be certainly unable to return into the lake. His remonstrance was disregarded and both sloops moved down the river without opposition until they were able to see the outline of the buildings on Isle aux Noix.

The garrison of the post on the island consisted of a subaltern's detachment of Royal Artillery and six companies of the 100th Regiment under Major George Taylor of the latter corps, Lieut. Colonel Christopher Hamilton, the actual commandant, being temporarily absent. Major Taylor had already received an intimation from a secret agent that a combined attack by the enemy's military and naval forces assembled at Burlington was probable before long. At 4.30 a.m. the topmasts and sails of a vessel rising above the dense fog which hung over the surface of the river, were dimly descried by a sentry who gave the alarm The Eagle was then rounding a bend in the stream less than a mile distant. Three row galleys brought up from Quebec, during the previous summer, were soon manned by soldiers of the 100th who had been frequently exercised in their management. The only officer of the provincial marine stationed at the island was Lieut. William Lowe but four junior officers of the 100th, Ensigns Dawson, Gibbons, and Humphreys and Quarter-master Pilkington, had been detailed to assist him. Each of the galleys was armed with a long six pounder in charge of three gunners of the Royal Artillery, and carried a crew of about twenty-five men. They were propelled by sails as well as oars and drew very little water. The galleys put off

[1] D. Murray to Mil. Secty., Mch. 24; Macdonough to the Secretary of the Navy, June 4.

to meet the approaching vessel but before they gained the first bend in the stream, near Arch island, another sail was discovered and they hurriedly opened fire on the one nearest them. Observing that the American vessels were moving slowly and had arrived in a narrow part of the river where they appeared to be within easy musket shot from the high banks on either side alternately, Major Taylor promptly ordered two bateaux and two rowboats to be manned for the purpose of landing parties to take advantage of this opportunity of annoying and co-operating with the attack of the galleys. These two detachments of troops, which were commanded by Captain Frederick Gordon of the Royal Artillery and Lieut. George B. Williams of the 100th Regiment, took post in the woods and thickets on either bank and began a brisk and effective fire. The greatest width of the stream at that point did not much exceed two hundred yards and the navigable channel was much narrower. In their efforts to tack and beat back toward the lake against the wind, for they had already abandoned all hope of a successful offensive, the sloops were obliged to stand in close to the highest ground on either side alternately to keep in the deep water and were much exposed to the musketry of these parties. A good many of their men were wounded and the remainder driven from the guns and compelled to seek shelter behind the bulwarks which were too thick to be penetrated by musket balls. The galleys, each of which was propelled by sixteen oars were able to move quickly and enter shallow water whenever it became necessary. They lay low beneath the decks of their adversaries and were very difficult to aim at. The action continued for almost four hours without material injury on either side until the forestay and main boom of the *Growler* were shot away carrying with them much of the running rigging. That sloop immediately became unmanageable and ran aground. A few minutes later the bottom of the *Eagle* was pierced by a round shot. It was found impossible to keep this hole on the weather side while attempting to tack and the vessel gradually filled and sank in shoal water until her deck was submerged a few inches. In this hopeless situation, Lieut. Smith had no alternative but surrender. Sailing Master Loomis, who commanded the other sloop, soon followed his example. One man had been killed and eight men were wounded on board the *Growler*. Eleven men were wounded on the *Eagle*, mostly by musketry from the land. Ninety-one unwounded prisoners were taken. Each of the prizes was armed with a long eighteen pounder, mounted on a circle, and ten carronades of the same calibre. They were amply equipped with small arms, cutlasses, boarding axes and pikes. The British force engaged numbered 108 of all ranks and arms and had three men wounded.

Just before the close of the action, a canoe from the island brought a message to Major Taylor, who had joined one of the parties on the mainland, which contained the alarming but entirely false information that several other hostile vessels were about to enter the river, attended by a land force estimated at three thousand men. Leaving orders for the boats to take possession of the prizes and bring them off if possible, Taylor hastened back to the island to complete his preparations for defence.[1]

As soon as information of this entirely unexpected success, reached Major General de Rottenburg at his headquarters in Montreal, he requested the senior naval officer at Quebec to lend sixty seamen with the necessary officers to command them for a few days to man the captured sloops for a short cruise in the hope of taking or destroying the American armed vessels and merchant shipping on Lake Champlain. He urged that this should be done at once with the utmost secrecy and proposed that the officers should travel in plain clothes and the men be told that they were on the way to join the squadron on Lake Ontario. Secrecy and rapidity of action were essential to complete success and success would enable him to despatch troops to any part of Lake Champlain. Captain Russell of H.M.S. Cygnet was then the senior naval officer at Quebec and he readily agreed to comply with the proviso that an embargo should be laid on all merchant vessels in that port from the 10th July until further orders to prevent them from attempting to sail without a convoy. Few of them would be ready to sail before the day named which had been positively fixed as the date of departure for the fleet under his protection and feeling certain that trade would not greatly suffer by this delay, General Glasgow recommended the imposition of this embargo by de Rottenburg who was acting as administrator of civil affairs during the absence of the Governor General in Upper Canada. Russell instantly detailed five officers and thirty seamen to whom one officer and seventy seamen were added by Captain Francis Kempt, who was in charge of a small fleet of transports lying in the river. Russell and Kempt both showed their zeal by volunteering for the expedition and left by the first steamboat for Montreal to complete the necessary arrangements.[2]

De Rottenburg immediately proclaimed an embargo for one month but having been transferred to the command of the troops in Upper Canada he was obliged to leave Montreal before the seamen arrived. He was succeeded by Major General Sheaffe who appointed

[1] Taylor to Major General Stovin, June 3; Prevost to Bathurst, June 7; Macdonough to the Secretary of the Navy, July 22.

[2] Glasgow to de Rottenburg, June 7.

Major General Stovin to the command of the proposed expedition with instructions to attack both Plattsburg and Burlington, disperse the troops occupying those towns and destroy the public buildings and stores. Captain Russell, however, after making a careful examination of the captured sloops which had been removed to St. Jean for repairs, came to the conclusion that they could not be made fit for service in less than a week and being unwilling to wait so long, actually returned to Quebec with his seamen before he knew that the embargo had been declared. Stovin was consequently obliged to defer the movement until another body of seamen could be obtained.[1]

When this misunderstanding became known to the Governor General, who had removed his headquarters to Kingston, he addressed a personal letter to the senior naval officer at Quebec, asking him if not entirely incompatible with his instructions from the Admiralty, to proceed to St. Jean with a detachment of his crew and such seamen as could be obtained from transports and merchant shipping in the harbour. He was instructed to take command of all armed vessels and gunboats in the Richelieu and cruise upon Lake Champlain, seizing every opportunity for capturing and destroying the enemy's vessels of every description and for landing parties to destroy military buildings and supplies wherever they could be found. The main object of the expedition was to delay the movement of any troops stationed on that frontier for the reinforcement of the American army on the Niagara. The arrangements made for obtaining information from sources within the hostile frontier appeared to be working well. Early in June an agent reported that about three thousand soldiers had assembled at Burlington and two thousand more were said to be on the march from Greenbush. Champlain village was occupied by five hundred regulars and volunteers with a field gun. Many boats were being built for the government service in the river Chazy. Another detailed report received almost a month later indicated that little change had taken place. A thousand recruits had arrived at Burlington from New England and nine hundred of the best men had marched off to Sackett's Harbour. Four hundred men were sick in hospital and apprehension of an attack had been assigned as a pretext for calling out a brigade of militia. Plattsburg had been entirely evacuated by the regular troops who had been transferred to the other side, it was stated, to check smuggling which had increased to an extraordinary degree. Considerable quantities of public stores had been left behind without any protection. Champlain village was still occupied by the same troops and Swanton was garrisoned by a slightly larger force of militia. A careful estimate

[1] De Rottenburg to Brenton, June 9.

in detail furnished to Ensign Dawson by a smuggler, stated the whole number of troops at Burlington, then commanded by Brigadier General Parker, to be 3,026, composed of one troop of light dragoons, a detachment of artillery with nine field guns, the 4th, 30th, 31st, and five companies of the 11th United States Infantry. This information, it would appear, was absolutely accurate. So far from entertaining any intention of acting on the offensive he asserted that they seemed to be in the greatest fear of an attack whenever the wind blew up the lake from Isle aux Noix.[1]

Captain Austin Cuvillier of the 5th Battalion of Embodied Militia, and member of the Legislative Assembly for the County of Huntingdon, made a daring and entirely successful reconnaissance of the enemy's post which had been established recently on the Salmon River and ascertained that it was occupied by such a small and inefficient body of militia as to be wholly negligible.[2]

Prevost's letter asking for seamen was delivered to Captain Pearce of H.M.S. Rifleman on July 9, who stated that his orders to sail from Quebec on August 1, were imperative, and besides he could not possibly comply without first obtaining leave from the Admiral commanding on the Halifax station as the senior officer acting in command in the Admiral's absence had already censured Russell for leaving his ship without orders and announced his intention of reporting his action.[3]

Twelve days later, the sloop of war Wasp, commanded by Captain Thomas Everard, arrived at Quebec, and the Governor General's letter was presented to him. It was accompanied by an extract from a report by Colonel John Murray, the commandant at St. Jean, stating that the enemy's force in the vicinity of Lake Champlain was being concentrated at Burlington in expectation of being reinforced for the purpose of invading Lower Canada. The appearance of even a very small naval force on the lake would probably derange their plans and delay this movement.[4]

Everard showed no hesitation in complying. His orders indeed restricted his stay at Quebec to fourteen days only, but he readily agreed to undertake any special service which could be accomplished in that time and would even shoulder the responsibility of extending the period for two or three days. Accident had brought upon the scene as energetic and enterprising an officer as could have been selected. No time was lost in unnecessary preparations and on the evening of

[1] Intelligence dated "Odletown, July 2;" Rowan to Baynes, July 8.

[2] Cuvillier to Lethbridge, June 19.

[3] Glasgow to Prevost, July 9.

[4] Everard to Sir John B. Warren, July 21.

the following day he embarked in the steamboat for Montreal with fifty men selected from his own crew and thirty volunteers from the transports. Arriving at Montreal on the evening of July 24, he was joined by Captain Daniel Pring who had just been appointed by the Governor General to command the naval force on Lake Champlain and was then on his way from Kingston to Quebec in the hope of enlisting seamen. Next day both of these officers went to Isle aux Noix where the sloops and gunboats were lying. The flank companies of the 13th and 103rd Regiments marched from Montreal for that post on the 26th to form part of the land force. Reliable information had been lately received from Joel Ackley and other secret agents stating that the whole of the enemy's military and naval forces had been concentrated at Burlington and as the troops at his disposal were not considered sufficient to warrant an attack on that place under these altered circumstances, General Sheaffe instructed Colonel Murray, whom he had selected for the command of the expedition, that its main object would be to create a general alarm and thus make a diversion in favour of the army in Upper Canada. He was directed to destroy all barracks and other military buildings at points lately occupied by the enemy and to remove or destroy public stores, boats, and vessels everywhere. Private property was to be strictly respected and protected from injury. All officers were required to be particularly vigilant in the prevention of straggling. Plattsburg was designated as the extreme southern limit of his operations in any event. Careful reconnaissance and due caution were specially recommended. Sheaffe, himself, went to Isle aux Noix to supervise the preparations. The flank companies of the 1st and 3rd Battalions of Embodied Militia stationed there expressed a strong desire to join the expedition, but he positively refused to employ any militia except thirty-five picked men from the 1st Battalion who were selected to assist in the management of the boats. The entire military force consisted of 39 officers and 907 other ranks with two light three pounder field guns.[1]

Captains Eliot and Loring of the general staff, who had acquired an intimate local knowledge of the adjacent country, were specially

[1] Return of a division of the army under command of Lieut. Colonel John Murray, Isle aux Noix, July 27, 1813.

Royal Artillery, all ranks	24
13th Regiment " "	189
100th " " "	234
103rd " " "	271
Canadian " " "	35
1st Batt. Embodied Militia	35
Total	946

detailed to assist the commanding officer. Loring in particular was well acquainted with the western shore of the lake as far as Plattsburg.[1]

Through the rash conduct of his immediate subordinate, Macdonough had not only been deprived of his two best vessels but the greater portion of his trained officers and seamen. He was once more compelled to seek authority from the Secretary of the Navy for the purchase of lake-craft and ask that both officers and seamen should be sent from the seaboard to replace his losses. A month elapsed before a reply was received. He was told to buy and equip two of the best sloops or other vessels to be procured and twenty eighteen pounder carronades were ordered forward from Boston to arm them. "You are to understand that on no account are you to suffer the enemy to gain the ascendancy on Lake Champlain," the Secretary wrote on June 17, "and as you have unlimited authority to procure the necessary resources of men, materials and munitions for that purpose, I rely upon your efficient use of the authority vested in you."

He was further directed to co-operate cordially with General Wade Hampton who had recently been appointed to the command of the military forces on that frontier. He was also authorized to build four or five gunboats of the galley type, for which Hampton was instructed to furnish mechanics and materials through the quartermaster general's department.

Eventually two large sloops were purchased and altered to carry ten eighteen pounder carronades and one long eighteen on a circle. Macdonough strongly favoured their armament with carronades as he said those guns were comparatively light and could be loaded with heavier charges of grape than long guns of the same calibre. He anticipated they would be chiefly employed against similar sloops or other small craft on which the crews would be unprovided with quarters and consequently much exposed to fire of that description. Much to his disappointment the guns and men required for them did not arrive as soon as he hoped. Until they came he had but three regular officers, all midshipmen, of whom only one had any practical experience, and a surgeon's mate. His remaining sloop, the President, was manned by fifty seamen of the United States Navy, all he had, and his two gunboats by infantry soldiers, each commanded by a captain, who had been detailed to act under Macdonough's orders. Since the opening of navigation these boats had been actively employed in the prevention of smuggling until the loss of the two sloops alarmed the Secretary to such a degree that he ordered them to be retained in the harbour of Burlington until they could be provided with crews

[1] Sheaffe to Prevost, July 25 and 29; Instructions to Murray, July 27.

of regular seamen.[1] Twelve officers and two hundred seamen were required to complete his complement. Pending their arrival all his vessels were removed from Plattsburg to Burlington for safety and anchored or moored under protection of the batteries constructed for the defence of that post where nearly four thousand troops had been assembled. With the exception of two regiments of volunteers, enlisted for one year, this force was entirely composed of regular troops. About the middle of July, General Hampton arrived and assumed command.[2]

On the morning of July 29, the British flotilla, consisting of the two captured sloops, which had been renamed the *Broke* and *Shannon*, three galleys and forty-seven longboats or bateaux, struggled slowly out of sight of Isle aux Noix. A body of American militia had assembled at the narrows near Windmill Point with the apparent intention of opposing its passage into the lake, but dispersed on being warned that if they ventured to fire upon or molest the expedition in any way, their dwellings and other property would be destroyed but would be unharmed if they remained quietly at home. A row boat, which was observed moving off, was overhauled and captured. Dr. Wood, a magistrate and chief collector of customs for the district of Champlain, was recognized as one of the prisoners. He boasted rather unwisely that he had already sent off information of their movement to General Hampton. As he was reported as having been extremely harsh and energetic in efforts to repress smuggling, he was sent off to Quebec as a prisoner of war.

At 10 a.m. Major General Mooers, commanding the New York Militia in the divisional area of Plattsburg, received information that a large hostile force had entered the lake and he immediately issued orders for the militia of Clinton County to hold themselves in readiness for active service. Early on the following morning Murray landed a strong party at Chazy where considerable public property was destroyed. This was soon reported to Mooers who then ordered two brigades of militia from Essex County to assemble for the defence of Plattsburg.[3]

[1] Macdonough to the Secretary of the Navy, June 4 and July 11.

[2] Field return of troops at Burlington, August 2, 1813.

	Present for duty.	Sick.	Total present and absent.
U.S. Light Dragoons	122	15	140
U.S. Artillery	76	14	90
U.S. Infantry	2441	367	3617
Volunteers	536	159	806
	3169	552	4053

Wilkinson's Memoirs, Vol. III.

[3] Mooers to Governor Tompkins, August 4.

During the day a proclamation addressed to the local magistrates by Murray and Everard was widely distributed among the inhabitants residing near the lake shore, informing them that if they remained peaceably at home, their property would be protected from injury.[1] When Murray's force appeared in sight of Plattsburg next morning, Mooers had with much difficulty assembled about three hundred men with a single field piece for its defence but abandoned the place without firing a shot on the approach of the landing party. Possession was immediately taken of the town which was occupied for ten or twelve hours. The arsenal, a large blockhouse, the commissary's store, and the commodious barracks lately built on the banks of the Saranac for the accommodation of four thousand men were set on fire and entirely destroyed. A considerable quantity of arms, military clothing, ammunition, and equipment for boats was brought off. While this was being accomplished, Colonel Murray landed, and entering into conversation with some of the inhabitants, he removed his cap and a paper which he had evidently placed in it for convenience or safe keeping fell to the ground unperceived by him. Observing this a ready witted bystander dropped his handkerchief over it and picked up both together. After Murray had gone away, it was found to be a precise and accurate statement of the force and situation of the American regular troops in the vicinity of the lake and, although unsigned, was recognized as being in the handwriting of Joel Ackley who was already suspected of transmitting information. He was soon afterwards arrested and made some admission, implicating a man named Paling who lived near the boundary. Paling learned his arrest in time to escape and report what had happened to the commandant at St. Jean. Measures were then taken through Leon Lalanne to employ counsel for Ackley's defence and secure his acquittal. Lalanne's efforts were eventually successful and after being confined in prison at Albany for nearly a year, Ackley was released without a trial.[2]

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[1] Proclamation, dated July 30.

[2] Mr. Lalanne's mission resulted in some singular negotiations with an unnamed leading lawyer in Vermont.

"Yesterday morning we sent for a respectable law character of Vermont, whom we have consulted this morning and has taken upon himself to rescue the prisoner (now at Albany), if the thing is any wise possible. He feels confident that his trial will not come on before October next and purposes setting out for Albany on the 10th prox. We feel happily disappointed. We looked upon the man as the ablest in that State to carry our plan into execution. Till about half an hour before he left us, we had no hopes of obtaining from him anything more than his advice, but he finally concluded to undertake it himself lest the person we should choose among those he had pointed out to us, should fail in the enterprise, and he exacted no further compensation than for his time and expenses which at the highest computation

On August 1, a detachment of troops was landed without opposition on Cumberland Head where another large blockhouse was burned and Everard then stood across the lake to reconnoitre the harbour of Burlington with the *Broke*, *Shannon*, and one gunboat, apparently with some hope of inducing the American armed vessels to come out and risk an action. He discovered two sloops of about one hundred tons each, armed with eleven guns, and apparently ready for service and another somewhat larger, still being fitted out. Two schooners, each mounting a single long gun, lay under the protection of a battery of ten guns, constructed on the crest of a steep bluff, rising a hundred feet above the level of the lake and commanding the channel leading into the harbour. In addition to these vessels two scows had been armed with heavy guns as floating batteries and several field guns were seen in position. A camp sufficiently large to accommodate five thousand men had been formed near the town and barracks and storehouses were under construction. Everard's vessels were swept within long range and opened fire. This was briskly but ineffectively returned by the battery and some of the boats in the bay at intervals for half an hour. Everard then made off in the expectation of being pursued and Macdonough actually got under way with five sail but after proceeding four or five miles came to anchor and finally returned before dark to his former station to the unconcealed mortification of thousands of spectators who had assembled on the heights.[2]

Everard next sent his galleys into Shelburne Bay, ten miles south of Burlington, where they captured a sloop and a schooner. Two bateaux, each manned by twenty-five men and armed with a light gun, went on to Charlotte where two sloops loaded with flour for the American army were taken. During the night these boats advanced twenty miles farther south and heard the sound of drums and musketry on both sides of the lake, indicating that a general alarm was being spread. In fact several thousands of militia were hastily embodied to resist an invasion.

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comes far short of what we expected any one would least ask. We have, however, told him if he should succeed, we would make an addition of a few scores of dollars to his daily salary. We have made him understand that the money in Mr. Ruiter's hands is raised by the sale of property which the prisoner had left in my care and at my disposal. He enjoined us not to mention (write) his name in any of our correspondence on this subject but permits its mention in our verbal communications to you only. It must, therefore, be concealed until one of us may have the honour of an interview with you."

Leon Lalanne to Sheaffe, undated but apparently written at St. Armand on August 28, 1813.

[2] Everard to Prevost, Aug. 3; Letters in the Federal Republican of Baltimore and the Albany Register of August 10, 1813; Macdonough to the Secretary of the Navy, Aug. 3.

Another detachment of boats landed a small body of troops at Swanton near the mouth of the Mississquoi River, which had been lately occupied by a battalion of volunteers. That village had been evacuated several days before and the barracks and storehouses with a number of boats were destroyed. In all eight sloops and schooners, being nearly the whole of the merchant craft upon the lake, except what had been collected for safety in Burlington harbour, were captured. Four of these, being considered fit for conversion into gunboats, were brought off and the others destroyed. On the way back to Isle aux Noix, Captain Eliot was landed with a detachment of the 100th at Chazy, and marched three miles inland to Champlain village where the barracks and commissary's store, containing a quantity of forage, were burned.[1]

Murray had thus succeeded in accomplishing in a very creditable manner all that could be reasonably expected without any loss except some twenty desertions. Sixteen soldiers of the 103rd, all of them convicts, who had been permitted to escape imprisonment by enlisting in the army, went off in a body. This corps was known to contain a large proportion of hardened criminals who were believed to be "capable of any villainy." Complaint was made by inhabitants of Plattsburg that the contents of three warehouses destroyed in that town, mainly belonged to merchants, and that other houses had been pillaged and private property wantonly destroyed, for which there was probably some ground.[2]

Everard lost no time in returning to his ship. An officer and twenty-one seamen destined for service on Lake Champlain had arrived and Pring went down to Quebec in the vain hope of enlisting a few more. A convoy of transports with de Meuron's Regiment on board had opportunely arrived there since Everard's departure and the officer in command eventually agreed to lend him sixty seamen, who would be permitted to remain as long as they were needed on the condition that they were sent back to Quebec in time to sail for England on the last troop-ship leaving before the close of navigation.[3]

Advantage was taken of the presumed effect of the expedition down Lake Champlain to arrange a general transfer of troops on the frontier. The detachment of the 100th Regiment which had been stationed at Isle aux Noix was ordered to join the forces in Upper

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[1] Everard to Prevost, Aug. 3; Eliot to Murray, Aug. 4; Mooers to Tompkins, Aug. 8; letter from Burlington, dated Aug. 3, 1813, in the New York Gazette of August 12, 1813.

[2] Baynes to Scott, Aug. 17. Scott MSS.

[3] Glasgow to Sheaffe, July 28 and 30; Sheaffe to Brenton, Aug. 1 and 2; Sheaffe to Prevost, Aug. 5.

Canada and the 103rd was removed to Quebec from Chambly to decrease the probability of desertions. These corps were replaced by the 13th at Isle aux Noix and by de Meuron's at Chambly.

Everard and Pring united in an urgent recommendation that the construction of a brig to mount sixteen guns and two large gunboats should be commenced at once. Sufficient timber for this purpose had already been collected at Isle aux Noix and a master builder, who had arrived there reported these vessels might be launched in two months if measures were taken to engage all the shipwrights that could be hired in Montreal and Quebec. Prevost readily approved of the immediate construction of the gunboats but unwisely withheld his consent as to the brig until an estimate of cost could be obtained. This caused so much delay that she was not completed until the following spring.[1]

By this time General Hampton's arrangements for obtaining intelligence had become fairly efficient. On the 1st of August, one of his scouts, accompanied by a deserter from the Canadian Fencibles, who said they had been instructed to ascertain in particular, whether Indians were being employed by the British, were captured within a few miles of Isle aux Noix.[2] The arrival of a party of shipwrights at that post soon became known to Macdonough and caused him to renew his application for an adepuate reinforcement of officers and seamen from New York.[3] Learning soon after, that Pring had increased his flotilla to an aggregate of four sloops, three galleys and two gunboats by the addition of prizes taken in the recent expedition, he responded by the purchase of the sloop Frances, which he armed with five guns, and by the conversion of two of his gunboats from sailing craft into row-galleys which enabled them to carry heavier guns.[4]

The general plan of offensive operations against Canada, had meanwhile been essentially modified. In January, 1813, Dr. Eustis had been replaced by General John Armstrong as Secretary of War. Six months before the declaration of war, Armstrong had advised his predecessor that Montreal ought to be made the principal objective for an invading army. Craig, Prevost and Brock had also agreed in the opinion that the frontier of that district was the most accessible and vulnerable part of Canada. If the line of communication between Montreal and Kingston should be at any time permanently interrupted, they frankly confessed that the fate of the troops defending the upper province would be no longer in doubt.

[1] Sheaffe to Freer, Aug. 8.
[2] Sheaffe to Brenton ,Aug. 2.
[3] Macdonough to Evans, Aug. 8.
[4] Macdonough to the Secretary of the Navy, Aug. 16.

After long hesitation and much anxious deliberation, President Madison had decided on the appointment of Armstrong, who was then in command of the troops in the city of New York, as being eminently well qualified by training and study for the control of the War Department. Monroe, the masterful Secretary of State, heartily disliked his new colleague and made no pretence of concealing his antipathy. Armstrong had served as aide-de-camp to General Gates during the campaign of Saratoga and subsequently as adjutant-general of the army commanded by that officer in the Southern States. He was believed to be the author of the inflammatory Newburg Addresses on the disbandment of the Continental army which had attracted so much attention and were strongly condemned by Washington as being seditious in their tone. His marriage into the wealthy and powerful Livingston family of New York had given him political influence which could scarcely be ignored. Jefferson had appointed him Minister to France and he had performed the difficult duties of that important post with firmness and judgment at a critical time. His interest in military affairs had never flagged and he had forwarded a copy of Grimoard's book on the Duties of the General Staff to the War Department immediately after its publication, with a strong recommendation that it should be translated. His opinions on military subjects seemed to be generally sound and were well expressed, and, although regarded as being constitutionally indolent, he sometimes displayed great energy and decision. He had just entered his fifty-fifth year but his health was unimpaired. It was an open secret that he had desired the chief command of the United States Army with the rank of Lieutenant General and only failed to obtain it through the determined opposition of Mr. Monroe who also sought that appointment.[1]

Very soon after assuming office, the new Secretary proposed to open the campaign of 1813, by a combined naval and military attack upon Kingston and the greater part of the troops at Plattsburg were moved in the depth of winter to Sackett's Harbour with that object at the expense of considerable suffering from frost bites. The forces assembled with that intention were diverted by their commanders, first against York and then against Niagara. A series of unsuccessful operations during the month of June resulted in the retirement of the invading army into an entrenched camp at Fort George, where it was blockaded and virtually reduced to impotence by a force numerically much inferior. News of the surrender of Lieut. Colonel Boerstler's command at the Beaver Dams on June 24, arrived in Washing-

[1] Ingersoll, History of the War of 1812-3, p. 267; Henry Adams, History of the United States.

ton on July 6 and brought matters to a crisis. Congress had been sitting for a month. The discontent and anger of the leading supporters of the administration could no longer be suppressed. A committee, composed of Henry Clay, then Speaker of the House of Representatives, and two other influential members, was appointed to call upon the President and demand the removal of General Dearborn and the appointment of a more competent commander. Mr. Madison was ill but they were received by the Secretary of State who told them that their request would be granted. Dearborn was instructed to turn over the command to Brigadier General Boyd, the next senior officer. Although Boyd was an officer of undoubted courage and some experience in actual warfare, the Secretary for War did not consider him capable of conducting operations on a large scale. Major General James Wilkinson, lately in command of the Department of the South, was next in rank to Dearborn, and therefore selected as his successor. He had already been ordered to report at Washington for service in the north, and might be expected to arrive any day, although his movements were known to be leisurely. He had served with Armstrong in the Revolution, on the staff of General Gates, who had selected him to deliver to Congress his despatch announcing the convention of Saratoga. He had been educated as a physician and possessed considerable natural ability combined with a courteous and agreeable manner. His military service had been practically continuous since the organization of the army. When he took possession of Louisiana, nearly ten years before, the French Commissioner described him as a vain, rattle-brained fellow, who had been guilty of innumerable foolish acts and had a bad reputation everywhere. He had since been tried and acquitted by a court martial for complicity in the conspiracy of Aaron Burr. His reputation had not improved since. The senators from the three states included in his department had so little confidence in his fidelity that they demanded his removal. The order relieving him from the command was dated March 10, but did not reach him until May 19. He did not leave Mobile until three weeks later and actually arrived in Washington on July 31, nearly five months after the order was written. A historian of eminence has styled him "the most infamous man then wearing the uniform of the United States."[1] He was undeniably sensual, unreliable, vain, and an irrepressible liar and braggart. His health as well as his character had suffered from constant dissipation.

Major General Morgan Lewis, then commanding at Sackett's Harbour was a brother-in-law to Armstrong, and owed his rank entirely to political and family influence. He was junior to Hampton,

[1] McMaster, History of the People of the United States, III, 26, 545.

and even his warmest friends did not consider him competent to command in the field. About the end of July, Peter B. Porter, the representative in Congress for the Niagara district of New York, a leader of the war party, as well as quartermaster-general of the State militia, whose political influence was powerful, became utterly disgusted with the apparent incapacity of the senior military officers serving on that frontier and wrote a vigorous letter to the Secretary of War, criticising their conduct at length and finally proposing that Armstrong should either assume the command in person or appoint Wilkinson. Armstrong had in fact continued on very friendly terms with Wilkinson although fully aware of his numerous defects in character and conduct. His appointment to the command was apparently forced upon him by the pressure of circumstances, contrary to his own judgment.

Fully convinced by this time of the futility of further operations in the Niagara peninsula, Armstrong wished to revert to his original plan of an attack upon Kinsgton as soon as the command of Lake Ontario could be regained. Sackett's Harbour was the most natural and convenient point of concentration of the troops and ships required to carry it out. The advance of a strong division from Lake Champlain to threaten and perhaps attack Montreal and its dependencies if those posts should be materially weakened for the defence of Kingston, was also contemplated. As an alternative to a direct attack on Kingston, he suggested the movement of the main body of troops from Sackett's Harbour to the village of Hamilton (now called Waddington), where, it was thought, the passage of the river might be easily made. After this was accomplished, a high narrow bluff between the river and an impassable swamp, must be seized and fortified to interrupt the British line of communication and serve as a base for future operations against Montreal in conjunction with the force from Lake Champlain. To ensure the success of the latter plan, the American fleet must command the river from Lake Ontario to Ogdensburg and send a flotilla of gunboats to gain possession of Lake St. Francis. Official returns, dated August 2, showed an aggregate of 14,356 regular troops in the Ninth Military District, of whom 4,053 were at Burlington, 3,668 at Sackett's Harbour, and 6,636 at Forts George and Niagara. The ineffectives included in this return numbered 2,528. The officer selected for the command of the force eventually assembled at Sackett's would be allowed to make a choice of these plans. A memorandum containing these proposals was submitted to the President on July 23 and approved the same day without alteration. Dearborn had already transferred the command of the troops on the Niagara to Boyd, who was instructed to remain

strictly on the defensive until he could be supported by the fleet. Congress adjourned on August 2, doubtless much to the relief of the cabinet who were then free to attempt the execution of their new plans without being worried by embarrassing questions and hostile criticism. Wilkinson had arrived a few days before. The proposed plan of operations was submitted to him on the 5th and he gave his opinion in writing next day formally approving of Sackett's Harbour as the point of concentration but remarking that either operation would be impracticable unless the fleet possessed the command of the lake which had not yet been secured. He declared his great anxiety to gain some initial success to inspirit the troops and "popularize the war" and considered that this could be accomplished with more ease and less loss in the vicinity of Niagara than anywhere else. Meanwhile he advised that the force at Burlington should be supplied with a train of battering cannon and mortars to co-operate in the siege of Montreal and that a strong force of volunteers and militia should be assembled on the frontier of Lower Canada near Lake Memphramagog with instructions to descend the St. Francis river and seize a position on Lake St. Peter. He knew that General Hampton was personally hostile to him and might not act with the necessary cordiality and vigour in a combined movement. Probably it was this apprehension that prompted him to ask for a copy of the instructions already given to that officer and request that all orders should be issued through him and that he might have power to detach from his command "all persons who may manifest a temper or disposition to excite discontent, to generate factions, or embitter the service."[1]

Armstrong promptly and decisively rejected the proposal to resume the offensive in the Niagara peninsula.

"The main objection to any plan which shall carry our operations wide of Kingston and westward of it, is that in the event of its success, it leaves the strength of the enemy unbroken; it but wounds the tail of the lion, and of course is not calculated to hasten the termination of the war, either by increasing our own vigor or diminishing that of the enemy. Kingston is the great depot of his resources and so long as he retains this and keeps open his communication with the sea, he will not want the means of multiplying his defences and renewing the war in the west.

"Kingston, therefore, as well on grounds of policy as of military principle, presents the first and great object of the campaign."[2]

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[1] Wilkinson to Armstrong, Aug. 6, 1813. American State Papers, Military Affairs, Vol. 1, pp. 463-4.

[2] Armstrong to Wilkinson, Aug. 8, Id., p. 465.

The reduction of Kingston, he remarked, could be accomplished either by a direct attack or "by seizing and obstructing the line of communication and thus drying up the resources by which the enemy is nourished and maintained." Wilkinson was positively ordered to make it the "primary object of his movement" but permitted to decide whether he would proceed by the direct or indirect method of attack. If he preferred the latter he was instructed to collect his forces "at the head of the St. Lawrence, make every demonstration of attacking Kingston, proceed rapidly down the river, seize the northern bank at the village of Hamilton, leave a corps to fortify and hold it, march upon Montreal with the main body, effect there a junction with Hampton, and take a position which shall enable you to secure what you gain."[1]

He was explicitly assured that all orders would be transmitted to him through the office of the Adjutant General and all improper communications to the Secretary of War would be declined and forbidden. General Hampton, Armstrong wrote, had only been authorized to concentrate and organize his division and it was intended that he should operate simultaneously with Wilkinson and under his orders.

Porter's letter to the Secretary was shown in confidence to Wilkinson, who wrote at once to that officer, asking him to send several spies into the camp and country of the enemy to gain information. One of them should be instructed to return to Fort George while the others went on to Kingston and finally reported at Sackett's Harbour.[2]

At first Armstrong intended to accompany Wilkinson, and when obliged to abandon this project, promised to join him somewhere on the frontier, a few weeks later. On arriving at Albany, Wilkinson wrote to Hampton, asking for a return of his division and suggesting that he should cross over to Plattsburg.[3] As he no doubt anticipated, Hampton was greatly irritated at the bare thought of receiving orders from a man he despised and made no reply. But he wrote at once to Armstrong, tendering his resignation and reminding him of a conversation in which he had assured him that the division under his orders would be regarded as a distinct and separate command within the district and that it would not be taken from him nor encroached upon by a superior in rank before the end of the campaign. Now he learned that even his local movements were to be directed by an officer who might be two hundred and perhaps four hundred miles away.[4]

[1] Armstrong to Wilkinson, Aug. 8.

[2] Wilkinson to Porter, Aug. 11.

[3] Wilkinson to Hampton, Aug. 16.

[4] Hampton to Armstrong, Aug. 23.

Wilkinson, who barely outranked him, had once before superseded him while in command at New Orleans. There had been a fierce quarrel on that occasion which Hampton had not forgotten. Born in South Carolina in 1754, Hampton had served with some credit under Sumter and Marion in the partisan warfare waged by those leaders in the Revolution. After the Federal Government was organized, he sat for two terms in Congress and was appointed a colonel in the regular army during Jefferson's first administration. He was promoted to be a brigadier-general in 1809 and given command of a military district. He owned great estates in South Carolina and Louisiana with thousands of slaves and it was but reasonable to believe that only a desire to serve his country and gain personal distinction, induced him to accept his present command. Extremely proud, hasty tempered and stubborn, it was scarcely possible for him to get on smoothly with superiors or subordinates. He regarded Wilkinson with the utmost aversion and contempt. It would be the depth of humiliation to serve under him. Armstrong succeeded in pacifying him for the time being by drawing a distinction between a separate and an independent command and the assurance that he would continue to receive his orders direct from the War Department.[1]

Wilkinson learned on his arrival at Sackett's Harbour that the superiority on Lake Ontario still rested with the British squadron, which had gained a considerable advantage in a recent action by the capture of two small vessels and the accidental loss of two other American schooners. The latest intelligence from Kingston led him to believe that Prevost was still there. The Secretary of War was requested to delay any movement by Hampton until his own plans had matured and he was able to attack Kingston or interrupt the communication between that place and Montreal. This might be effected by September 26. Meanwhile Hampton ought to occupy Plattsburg and be ready to begin an energetic advance by that date. He expected to begin his movement down the lake from Niagara at least five days earlier. Any premature demonstration by Hampton might draw Prevost to Montreal at once and induce him to make preparations for defence which otherwise would be neglected. The assembly of a considerable body of New York militia on the frontier of which he had already received notice "would increase the alarm and put all Canada in commotion." The Governor was accordingly requested to defer it.[2]

A flag of truce came over that day from Kingston on some trivial pretext and had, he surmised, been sent for the purpose of ascertaining

[1] Armstrong to Hampton, Aug. 25.

[2] Wilkinson to Armstrong, Aug. 21; Wilkinson to Tompkins, Aug. 21; Tompkins Papers Vol. VIII, pp. 577-8.

whether the American fleet was still in port, and in this mission the officer in charge was entirely successful.[1]

Next day an American seaman who had escaped from his guard near Ernestown, came in and reported that he had seen the Governor-General, attended by a single staff officer and a small mounted escort, five days before, riding from York toward Niagara, and that during his flight, he had observed a detachment of regular troops moving up the Bay of Quinte in boats.

Suspecting from this that an attack was meditated upon Fort Niagara and the batteries and magazines on that side of the river, a messenger was despatched in all haste to warn Boyd to be on his guard "as their loss would disgrace our arms, blast your cause, and ruin the campaign."

Wilkinson remained at Sackett's Harbour until August 30, busily employed in inspections of the troops and fortifications and in making arrangements for the transportation across the lake of at least seven thousand men, with forty pieces of field artillery and twenty siege guns, amply provided with ammunition, camp equipage, provisions and other supplies for a campaign lasting two months. He proposed that five thousand men should embark at Niagara about September 10 and the remainder at Sackett's Harbour on the 15th and form a junction at some point below Kingston. A council of war was then assembled, composed of Commodore Chauncey and three general officers, Lewis, Brown, and Swartwout, the latter being the quartermaster-general for the military district. Four questions were submitted for their consideration in reply to which they unanimously stated their opinion in writing that it was unnecessary to await the result of a decisive action between the opposing squadrons on Lake Ontario and inadvisable to undertake further offensive operations in the vicinity of Fort George and approved of the proposed movement down the St. Lawrence for an attack upon Montreal in conjunction with General Hampton. "The object appears feasible," they remarked, "and, if accomplished, the upper country must fall of course, being incapable of subsisting the enemy's force for any length of time and the possession of Montreal will certainly destroy the enemy's line of communication between the upper and the lower province."[2]

Chauncey readily promised to take the lake as soon as his new ship was equipped with the intention of seeking a decisive engagement. Hampton, however, had ignored all letters addressed to him,

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[1] Yeo to Prevost, Aug. 22; Wilkinson to Boyd, Aug. 23; Boyd's Documents and Facts, p, 15.

[2] Wilkinson to Swartwout, Aug. 25; Wilkinson to Armstrong, Aug. 26; Minutes of Council ôf War, Aug. 26; Wilkinson to Armstrong, Aug. 26.

and in reporting this, Wilkinson made the remark, "I hope he does not mean to take the stud; but, if so, we can do without him and he should be sent home."[1]

A requisition for two thousand militia for service at Niagara and an equal number to assemble at Plattsburg had been already made upon the Governor of New York who could be relied upon to make every effort to comply. This was now supplemented by another calling for three thousand five hundred more, of whom fifteen hundred were intended for Niagara and the remainder were to be held in readiness for service wherever required.[2]

The squadron failed to sail before the evening of August 29. It was then known at Sackett's Harbour that Yeo had passed the group of islands called the Ducks bound for the head of the lake on the 20th, and a collision seemed inevitable. "What an awful crisis have I reached," Wilkinson wrote in unconcealed agitation, next day. "If Sir George beats Boyd and Sir James, Chauncey, my prospects are blasted, and the campaign will, I fear, be lost. If Sir George beats Boyd and Chauncey beats Sir James, Kingston may yet be ours; but should both knights be beaten and our quartermaster find transportation in season (of which I have fears as I found none here), then we shall certainly winter in Montreal unless discomfited by some act of God."[3] He had then come to the conclusion that the British commanders were assembling their whole available force for a combined attack upon the forts at the mouth of the Niagara and urged that the militia already called for should be organized and marched to their destinations at once and that Hampton should be ordered to cross Lake Champlain and move upon St. Jean, taking Isle aux Noix on the way if possible. By this demonstration, he anticipated that the militia at Montreal might be drawn to the right bank of the St. Lawrence and the island would fall an easy prey to the force descending the river. At the same time he asked that four thousand "of the best appointed yeomanry" should be directed to assemble at Hamilton "for eventual operations with this army" or to support Hampton if necessary. He had been informed that Kingston was weakly garrisoned but he was unable to seize the opportunity to attempt a surprise at once as he had detached eight hundred men with nearly all his boats as a feint in the direction of Niagara to mislead the enemy.

A satisfactory organization of Hampton's division actually required more time and attention than had been expected as a large

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[1] Wilkinson to Armstrong, Aug. 30.

[2] Armstrong to Tompkins, Aug. 29, Tompkins Papers, VIII, p. 509; Wilkinson to Armstrong, Aug. 30.

[3] Wilkinson to Armstrong, Aug. 30.

proportion of the troops, although nominally regulars, were in fact untrained recruits of low quality. Armstrong's smooth assurances of confidence and unabated friendship had put their commander in high good humour and he announced that he would be prepared to begin operations early in September with four thousand effective men, exclusive of militia. Armstrong received this encouraging assurance at Albany when on his way to Sackett's Harbour, where he had determined to establish his headquarters for some time to direct the movements of both divisions. He lost no time in advising Wilkinson that Hampton would co-operate cordially during the campaign and resign as soon as it was concluded. Hampton was at the same time informed that both Prevost and Yeo had gone to the head of Lake Ontario, thus leaving Montreal open to an attack and urged not to neglect such an opportunity.[1]

A combined naval and military attack upon the American positions at Forts George and Niagara had indeed been under consideration by Prevost for some time and mortars and other heavy artillery had been forwarded from Quebec and Montreal for that purpose. He joined de Rottenburg with the obvious intention of directing the operations but a reconnaissance in force of the works on the right bank had convinced him of the futility of an assault before siege artillery and a large reinforcement of troops could be brought up from Kingston. Then on the afternoon of August 25 he was informed that the American Secretary of War accompanied by General Wilkinson had actually arrived at Sackett's Harbour, where he knew that a considerable concentration of troops had been accomplished for some purpose. This report decided him to abandon his design of an attack there and caused him to return as speedily as possible to Kingston.

When Armstrong arrived at Sackett's Harbour, he learned that Prevost was once more at Kingston. He then determined to assemble two thousand militia at Champion, a small village, some twenty-four miles inland, where the roads from the interior forked, with a view of creating uncertainty as to their destination if it became known to the enemy. The employment of any larger force of militia than this for the interruption of the British line of communication by the St. Lawrence seemed inadvisable "since it must be propped by a regular force, otherwise the back door may not be sufficiently closed and barred."[2]

Hampton soon wrote that no movement on his part would be practicable before September 20, and that a direct attack upon Isle

[1] Armstrong to Wilkinson, Sept. 6; Armstrong to Hampton, Sept. 1.

[2] Armstrong to Wilkinson, Sept. 6.

aux Noix, "a place of immense strength, was impossible without a decided naval superiority in the narrow waters," which he did not possess. He had decided that he must advance by the road leading to L'Acadie. Information had reached him that five thousand regulars and three battalions of Embodied Militia were stationed in the Montreal district.[1]

Armstrong ordered two additional regiments of regular infantry to march from the seaboard to Plattsburg but at the same time informed Hampton that a deserter from a British detachment on its way up the St. Lawrence had just come in and reported that the whole regular force in Montreal when he left did not exceed a thousand men. From Wilkinson he had not received a line for ten days and naturally felt greatly annoyed.

Desertion from the regular regiments stationed in Lower Canada still continued to such an alarming extent that the severest measures became necessary to check it. On August 7, a private soldier of the 103rd and one belonging to the Canadian Fencibles were shot under sentence of a court martial in the presence of the garrison of Chambly. Singularly enough another private of the 103rd, who had attempted to desert no less than four times unsuccessfully, was pardoned on consenting to serve in the army for life.[2]

It soon became evident that the substitution of de Meuron's for the 103rd at Chambly was not likely to result in any great improvement in that respect. This foreign corps had been recruited to a great extent with deserters and prisoners of war from Napoleon's armies, who had enlisted for service in North America to gain their liberty. Besides some Frenchmen, its ranks contained many Germans, Poles, Italians and Swiss. On parade it presented a fine appearance as the men were mostly young and robust and apparently well disciplined. In officers it was lamentably weak and a majority of them were very young and inexperienced. The regiment had scarcely arrived at its new station when ten French soldiers deserted in a body, taking their arms. They were swiftly pursued by a party of the 13th with some men of the Fourth Battalion of Embodied Militia, commanded by Ensign Hugh McQuarters of the latter corps. Overtaken shortly after dark the deserters opened fire and a desperate hand to hand conflict began. Sergeant Hoburn of the 13th killed one of them and wounded another with his pike. Eventually four of the deserters were killed and three badly wounded and taken prisoners. The others who escaped were all more or less wounded. General Glasgow declared that the result of this encounter would have a more

[1] Hampton to Armstrong, Sept. 7.

[2] Stovin to Sheaffe, Aug. 7.

beneficial effect on the regiment than if the offenders had been shot after trial by court martial. Ensign McQuarters was immediately promoted to the rank of lieutenant in the Frontier Light Infantry in recognition of his "spirit and activity."[1]

Frequent reports of unremitting activity in the American camp at Burlington and information that a call had been made upon the militia of the States of New York and Vermont resident near the border of Lake Champlain for three month's service, accompanied, it was said, by a promise that if they would march wherever they were wanted they would not be brought out again, caused General Sheaffe to pay a hurried visit to all the military posts near the frontier from Isle aux Noix to Chambly. De Meuron's corps was retained at Chambly and the 13th divided between that post and Isle aux Noix. The Canadian Voltigeurs with a troop of dragoons and two light field guns were pushed forward from St. Phillippe to L'Acadie and the Canadian Fencibles advanced from Laprairie to St. Phillippe. By great exertions five hundred horses were at length obtained to mount the 19th Light Dragoons, most of them being smuggled over from Vermont. Three troops of that fine regiment were distributed among the posts on the right bank of the St. Lawrence for orderly service. A hundred men of the Sedentary Militia were employed in the improvement of the roads from L'Acadie to the rear, and, the harvest being then practically finished, Sheaffe recommended that a considerable body should be called out for military duty.[2]

Isle aux Noix, St. Jean, L'Acadie and all posts on the line of communication between Montreal and Kingston were strongly occupied and Montreal itself was practically left without any garrison besides the local militia.[3]

Learning that troops were being transported across the lake from Burlington to Plattsburg, Pring sailed from Isle aux Noix in the hope of delaying or preventing this movement. By this time Macdonough had received a draft of two hundred able seamen and completed the equipment of all his vessels. His flotilla was then composed of five sloops, two of which were classed as transports, although armed with some long heavy guns taken from the floating batteries, two row

[1] Sheaffe to Prevost, Sept. 9; Glasgow to Freer, Sept. 11; Quebec Mercury, 1813.

[2] Sheaffe to Prevost, Sept. 9.

[3] Distribution return of troops in the Montreal District, Sept. 15, 1813; Montreal, 361; Chambly, 1,404; St. John, 885; Isle aux Noix, 1,006; St. Phillippe, 236; St. Hyacinthe, 38; blockhouse at St. Hyacinthe, 21; South River, 21; Laprairie, 546; L'Acadia, 638; Chateauguay, 21; Three Rivers, 100; William Henry, 115; Lachine, 19; Coteau du Lac, 278; Cascades, 136; Cedars, 21; Prescott, 927; Total, 6,808. Sick, 626. On command, 413. On leave, 17. Present fit for duty, 5,725. Freer Papers.

galleys and a small steamboat, the first vessel of the kind ever launched on Lake Champlain. Convinced of his great inferiority both in guns and men, Pring soon retired into the river and Macdonough took up a favourable position for covering the passage of Hampton's division, in a bay on the western shore.[1] Within ten days from the time of starting the transfer of the whole force across the lake with its stores and artillery was accomplished without molestation and a camp established on Cumberland Head. Burlington was immediately occupied by a brigade of Vermont militia under General Fassett and General Hopkin's brigade of New York militia began to assemble very slowly at Plattsburg. Hampton's regular force was composed of one squadron of cavalry, a strong detachment of artillery with ten guns, and eight regiments of United States infantry numbering rather more than five thousand of all ranks and arms. Two more regiments of infantry, the 10th and 32nd, were on the march to join him. It was deemed necessary to enforce discipline by an extreme punishment and a deserter from the artillery was shot in the presence of the whole force on Sept. 16.[2]

On the afternoon of that day, a patrol arrested a civilian on his way to the frontier with a detailed and fairly accurate statement of each corps in the division, where they were encamped, and a sketch, showing the position of the batteries and armed vessel.[3]

As it seemed certain that serious invasion of the province by the left bank of the Richelieu was in contemplation, Sheaffe gave orders on Sept. 19 for the obstruction of all roads on either flank of Odelltown and that arrangements should be made for blocking up the main road to L'Acadie and destroying the bridge over the La Colle River whenever it appeared absolutely necessary. These instructions were admirably executed by bodies of the Sedentary Militia of the neighbourhood under the personal supervision of Lieut. Colonel Charles Fremont, a deputy-quartermaster-general of militia, lately in command of the St. Valier division, whose local influence and knowledge of the country proved of the utmost value.

Shortly before dark, Hampton began his advance, the cavalry and artillery marching by road and the infantry being embarked in open boats under the escort of Macdonough's armed vessels moving on the outer flank. Chazy was reached at midnight when the infantry landed and two strong detachments of picked men under Majors Hamilton and Snelling were sent forward to surprise the British outposts at Odelltown and Rouse's Point. Both these parties lost their

[1] Macdonough to Secretary of the Navy, Sept. 9.

[2] Sheaffe to Prevost, Sept. 11; National Advocate, Sept. 25.

[3] Letter in National Advocate, Sept. 25.

way or were led astray by their guides in the darkness. Snelling arrived at Odelltown about daybreak. An outlying piquet was easily dispersed and four men who sought refuge in a house were surrounded and taken. The main body of the outpost consisting of a detachment of the Frontier Light Infantry and a few Indians commanded by Captain St. Valier Mailloux, held its ground staunchly behind the abatis until reinforced in the first instance by Major Perrault with the flank companies of the Fourth Embodied Militia and a few hours later by Major de Salaberry with two companies of Voltigeurs from L'Acadie.[1]

During the day Hampton's whole force came up and encamped near Odelltown, a primitive hamlet composed of a few small log houses, surrounded on all sides by woods. A dense forest or rather a swamp of hemlock trees, penetrated only by a narrow winding road, which was certain to be obstructed in many places by felled timber, lay between it and the nearest Canadian settlements. The infantry carried five day's provisions and Hampton had undoubtedly intended to press on rapidly as far as L'Acadie. A large body of axemen and labourers accompanied the troops for the purpose of clearing the road and rebuilding bridges for the passage of carriages. In the course of that afternoon his outposts were several times alarmed or briskly attacked by small parties who killed one man and wounded others. They quickly retired or were driven off and the thickets affording concealment were searched but they continued to hover about and disturb the camp during the night. When day dawned it was discovered that all the wells and springs had become completely exhausted and no water could be had for either cooking or drinking. It became necessary to send all the animals back to the village of Champlain, four miles in rear, to be watered. The troops were already suffering from thirst and there seemed to be no means of supplying them on the march as it was reported that the streams in front were entirely dry. A council of war composed of all the commanding officers decided without a dissenting voice that any further advance was clearly impracticable and advised that the road leading down the Chateauguay should be selected instead. The distance to be traversed was seventy miles longer but water was reported plentiful, the road was as yet unobstructed and unguarded, and the two divisions of the army would be brought much closer together. The problem of supply, already difficult, would, indeed, be considerably aggravated, but it would no longer be necessary to mask Isle aux Noix, or provide against a possible flank attack. The new objective was Caughnawaga, nearly opposite Lachine, forty miles from Chateauguay Four Corners, in the State of New York, which was designated as an advanced base.

[1] Coffin. The War and its moral, p. 243.

Hampton retired the same afternoon to Champlain and next day began a leisurely march westward by a somewhat circuitous and difficult road through the woods along the left bank of the Little Chazy river. Early on the morning of the 25th, when at Pomeroy's house, only thirteen miles from the Four Corners, he received a letter from Armstrong, dated at Sackett's Harbour on the 19th, asking him to delay his movement for five or six days, as Wilkinson would certainly be unable to leave Niagara before the 30th and warning him of a rumour that Prevost was about to return to Montreal. Colonel Atkinson, Inspector General of the division, was at once sent off to give the Secretary the most complete information of the state of the troops, whose "perfect rawness," Hampton wrote, "caused him much anxiety." He also requested that the First Dragoons, then marching from Utica to Ogdensburg, might be ordered to join him. In his next letter, Armstrong warmly approved of the Four Corners as a starting point. "Hold it fast till we approach you," he said. He considered an advance by this route much preferable to the one at first proposed as it wouul "ensure safety and concert," and added that he was not disposed "to incur any risks by *separate* attacks when *combined* ones are practicable and sure." In compliance with these instructions Hampton encamped at the Four Corners and remained there awaiting further orders for twenty-six days. This time was employed in training his troops, in cutting and improving a more direct road to Plattsburg, and in bringing forward his artillery and provisions and supplies for two months.

To create a diversion and to terminate what he described as "the shameful and corrupt neutrality on the lines," he directed Colonel Clark, whom he had left in command at Burlington, to make an incursion into Canada in the vicinity of Mississquoi Bay.[1]

Reports from different sources on the frontier were strongly corroborated by a short message in cypher from Thomas Barclay, the British agent for prisoners in New York city, stating that all the regular troops stationed in the forts and garrisons on the seaboard had been relieved by militia and placed under orders to march to the seat of war on the lakes and that the most capable officers in the army had been selected to command them. It was intended that the invasion of Canada should be made simultaneously from three directions at once, the frontier near Lake Champlain being named as one of these bases.[2]

Prevost immediately decided to remove his own headquarters from Kingston to Montreal, where he arrived on September 25,

[1] Hampton to Armstrong, Oct. 4.

[2] Barclay to William Hamilton, Sept. 5.

having directed Lieut. Colonel George Macdonell to follow him with the light battalion of flank companies of the Embodied Militia of Lower Canada, which had been stationed there for several months under his command. Sheaffe had already called out three thousand sedentary militia residing on the right bank of the St. Lawrence and made preliminary arrangements for the occupation of a new line of resistance to oppose any advance into the province from the direction of the Four Corners. Prevost considered the situation sufficiently serious to justify a call for five thousand more. Major General Stovin was then appointed to command the advanced line which extended from the Chateauguay river through the townships of Sherrington and Hemmingford, a distance of more than forty miles.[1]

The fortifications at St. Jean and Isle aux Noix were garrisoned by the battalion companies of the 13th Regiment, one company of the 10th Battalion of Royal Veterans, and the Fourth Battalion of Embodied Militia less its flank companies. The reserve under the immediate command of Major General Sir Roger Sheaffe consisted of the car brigade of field artillery, one squadron of the 19th Light Dragoons, the company of guides, a provisional battalion formed of the flank companies of the regiments of the line, four companies of the Regiment de Meuron, eight companies of the 3rd Battalion of Embodied Militia and the whole of the sedentary militia of the districts of Longueuil, Boucherville and Vercheres. The right of this force occupied Laprairie and the line of defence extended through St. Pierre, St. Philippe and L'Acadie to St. Jean. The Montreal Volunteers and three battalions of Montreal Town Militia were organized into a provisional brigade under Colonel, the Honourable James McGill, for garrison duty.[2]

It was soon ascertained that Hampton had formed a semi-permanent camp at the Four Corners but it was still quite uncertain what line he intended to adopt for his further advance as roads or practicable trails led from that place to St. Pierre, Caughnawaga,

[1] Composition of Stovin's force.
- Two three pounders with a detachment of Royal Artillery.
- One troop of the 19th Light Dragoons.
- Captain Watson's troop (Dorchester Provincial Cavalry).
- Canadian Fencible Light Infantry (four companies).
- Canadian Voltigeurs (four companies).
- Frontier Light Infantry (two companies).
- 1st Battalion Embodied Militia.
- 2nd Battalion Embodied Militia.
- The Chasseurs and Sedentary Militia of Beauharnois and Chateauguay and the First and Fourth Battalions of the Eastern Townships.

[2] General Order, Sept. 27.

and St. Regis as well as several intermediate points on the shores of Lake St. Francis where he might join a force descending the St. Lawrence. The strength of his division was very accurately reported and it was known that a considerable reinforcement of regular infantry was not far distant.

He had scarcely reached his new base when he received a letter from the Secretary of War stating that the departure of the American fleet from Sackett's Harbour for Niagara had been unexpectedly delayed and warning him not to advance beyond Malone or the Four Corners until he knew that Wilkinson's corps were actually in motion. A courier from Sackett's Harbour, travelling by the shortest route, ought to deliver a despatch to him in thirty hours, after receiving which, he would have ample time to force his way to Caughnawaga before Wilkinson could arrive there by the water route.[1]

The brigade of New York militia which had been assembled at Plattsburg was ordered forward to the Four Corners and its advanced guard had arrived at Pomeroy's tavern when it was hastily recalled by Brigadier General Parker in consequence of a false report that an attack was contemplated on that town. It was then split up into detachments which were stationed at Plattsburg, Champlain and Mooerstown to guard the line of communication parallel with the frontier.[2]

This alarm was probably caused by some demonstration by the flotilla at Isle aux Noix under Captain Pring, who felt, however, that his force was much too weak to risk an encounter with Macdonough as he had only forty seamen, nine marines and a boy to oppose at least 250, and he believed his adversary to be much superior in armament as well. His row galleys gave him a certain advantage in the river and the shallow waters of the lake which his wary opponent took immediate measures to overcome by undertaking the construction of two galleys at Plattsburg. Pring on the other hand had at length obtained the necessary authority for building a brig to carry eighteen guns.[3]

Hampton did not long remain unmolested. On the very day of his arrival at the Four Corners a small patrol was ambushed and dispersed with some loss by a party of Indians and militia led by Captain Gamelin Gaucher. Five days later the same enterprising partisan attacked an outlying piquet, killing Lieut. Nash and a private of the 33rd United States Infantry and wounding another man. He failed to make any prisoners, although doubtless that means of gaining in-

[1] Armstrong to Hampton, Sept. 25.

[2] J. S. van Rensselaer to S. van Rensselaer, Oct. 5.

[3] Pring to Freer, Oct. 5; Pring to Prevost, Oct. 10; Freer to Pring, Oct. 15; Macdonough to the Secretary of the Navy, Sept. 9 and Oct. 18.

formation was his principal object. These affairs and the uncomfortable sense of insecurity caused by the knowledge that hostile patrols were constantly hovering about his outposts caused considerable apprehension which Hampton endeavoured to remove by engaging some of the Indians from St. Regis as scouts. He met with little success in this expedient and described them scornfully as "poor devils."[1]

Civilian spies were also employed by Prevost to secure information; some of them entering the enemy's lines from the frontier of Lower Canada, others crossing the St. Lawrence from Cornwall or Prescott. Their reports generally agreed in stating that the troops being assembled at Sackett's Harbour were expected to co-operate with those at the Four Corners in a movement against Montreal.

Every practicable measure was taken to increase the available means of defence. A considerable number of the Indians of Lower Canada were already in the field. Sir John Johnson was instructed to assemble all those who had remained behind at Caughnawaga and were fit for service and despatch them without delay to the advanced posts on the Chateauguay river. Orders were issued that in the event of an invasion, the bells should ring the tocsin and other signals of alarm should be made in every parish within fifty miles of Montreal on which all the militia without any exception were required to assemble with their arms or if they had none, with axes, spades and picks. All those living on the south side of the St. Lawrence were ordered to assemble at Caughnawaga while those residing on the banks of the Richelieu and Yamaska were to march to St. Jean or L'Acadie. The militia of the island of Montreal and the left bank of the St. Lawrence as far east as Berthier were directed to march to Montreal.[2]

Colonel Clark began his active operations for creating a diversion from the frontier of Vermont by landing with three hundred volunteers and militia at Caldwell's Manor on the shore of Mississquoi Bay about midnight of October 10-11, apparently for the purpose of taking some of the local militia officers at their homes. Failing in this, some of their houses were pillaged by his undisciplined followers. They were then hastily re-embarked and while it was still dark another landing was effected at the mouth of Rock River in the State of Vermont, three miles south of the village of Philipsburg in the seigniory of St. Armand. In compliance with a recent order about one hundred men of the Fourth Battalion of the militia of the Eastern Townships had assembled there two or three days before under command of

[1] Hampton to Armstrong, Oct. 4; J. S. van Rensselaer to S. van Rensselaer, Oct. 5.

[2] General order, Oct. 8; Freer to Johnson, Oct. 5.

Major Joseph Powell. They had received so little training that he declined to arm any but those actually detailed for guard duty. Clark succeeded in surrounding the place before daybreak. The guard took the alarm and fired a few shots which wounded two of his men. A heavy volley was returned which killed one man and wounded three of the guard. All resistance then ceased. Major Powell with five other officers and eighty men surrendered. Only five escaped. The arms and ammunition held in store for the use of that portion of the battalion were taken. The prisoners were marched off to Burlington and eventually sent to the depot at Greenbush with the object of intimidating the remainder of the Canadian militia from serving on the frontier. Bitter complaints were made by several of the inhabitants that their houses had been broken open and pillaged.

During the morning a much larger force, accompanied with three pieces of artillery arrived in boats from Plattsburg under escort of an armed sloop and two gunboats. Several hundred men were landed with one field piece and marched to Philipsburg while foraging parties were sent about to the neighbouring farms to drive off the horses and cattle. They re-embarked before dark but were compelled to land again by a high contrary gale of wind which prevented them from beating out of the narrow entrance of the bay. Their awkward predicament was soon reported to Lieut. Colonel Weller at Isle aux Noix, who directed Captain Pring to proceed to the mouth of the river while he made ready a body of troops with some artillery for a combined attack. Before permission for this operation was obtained from General Sheaffe at Laprairie, the wind changed and enabled the raiders to escape unharmed. The village store and several houses were plundered by them. It seems almost certain that these depredations were committed with the connivance if not the open approval of the officers in command in pursuance of the cynical instructions from General Hampton "tó break the truce and should other means fail, to act the part of the mischievous urchin, who, to get two peacable *tabbies at 'making the fur fly'* holds them together by the tail."[1]

A trifling night attack made a few nights before upon a piquet of the Frontier Light Infantry near Odelltown irritated Major Perrault, the commandant of that post, to such a degree that he instantly sent a written warning to the inhabitants of Champlain that if they permitted any of the militia there stationed to cross the line, he would make reprisals upon their village. This threat had the desired effect.[2]

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[1] Hampton to Armstrong, Oct. 4; Kingston Gazette, Nov. 6; Weller to Sheaffe, Oct. 12; Sheaffe to Freer, Oct. 13.

[2] Perrault to Judge Moore and the inhabitants of Champlain, Oct. 10.

After the road to Plattsburg had been improved to his satisfaction, Hampton was joined by a brigade of New York militia, commanded by General Hopkins, which was rather unwisely pushed forward to occupy the most advanced position at the Douglas settlement within three miles of the boundary, whence all but a few regular troops had been withdrawn. A log fieldwork and blockhouse had been built at that place and named Fort Hampton, but was also sometimes known as Fort Hickory.[1]

As two weeks had then elapsed without receiving any orders or message of any kind from the Secretary of War, Hampton naturally became very uneasy.

"My solicitude to know your progress and the real state of the *grand army* is extreme," he wrote. "It is perhaps not less necessary for both that I should be constantly informed. Implicit faith, cordiality, and concert ought to unite our efforts. These have formed the basis of our exertions so far and promise more than our numbers the result so much desired. I have no reference to individuals but to the *heart* of every man. The point and moment of our junction is all important and that and not the moment of my departure from hence ought to be indicated because I ought to be the best judge of the time necessary to surmount the obstacles in the way. Between this and Caughnawaga much work on the road is necessary and I ought to advance upon it two or three days earlier than might be judged necessary on a smooth and solid road. By seizing and holding important points in front, the work could progress in my rear without incurring risk until I arrived within striking distance. You have said 'hold fast' and it might be considered precipitate to advance before I hear at least that the Rubicon is passed above."[2]

This letter was carried by Major Parker, an officer in whom he placed much reliance. While awaiting a reply all the teams and waggons that could be found in the surrounding country were impressed and brought into camp and an order was issued warning the troops to be in readiness to move at two hours' notice and all officers were required to reduce their personal baggage to the lowest limit.

On the 18th a letter from Armstrong, dated two days earlier, arrived by express, stating that Wilkinson's troops would begin their advance that day from Sackett's Harbour to Grenadier Island but that it was still undecided whether their next movement would be against Kingston or in the direction of Montreal.

"The *manœuvre* intended is lost, so far as regards Kingston," Armstrong added dolefully. "What we now do against that place

[1] J. S. van Rensselaer to S. van Rensselaer, Oct. 15.

[2] Hampton to Armstrong, Oct. 12.

must be done by hard blows and at some risk. The importance of the object may, however, justify the means. In the other case, (an immediate descent of the St. Lawrence), the army will make its way to the Isle Pierrot whence we shall immediately open a communication with you. Under these circumstances you will approach the mouth of the Chateauguay or other point which shall favour our junction and hold the enemy in check. Your known vigilance and skill make it unnecessary to suggest any measures of precaution against the enterprise of the enemy while you remain within stroke of him."[1]

A few deserters had come into Hampton's lines from whom he ascertained that two lines of defence were being fortified on the left bank of the Chateauguay, one six miles below the confluence of the English river and the other about as much further down the stream. One of these men, who had arrived that day, reported that the advanced position when he came away was occupied only by 350 sedentary militia under a militia officer, and the other by 650 regulars and 700 embodied militia. This information decided Hampton to begin his advance at once as he thought that "there had arisen a condition of things which as he understood the plan of campaign, permitted, if it did not enjoin, an attack on Montreal."[2]

Meanwhile energetic and unremitting efforts had been made by General Stovin and the officers under his command to secure reliable and accurate information of all hostile designs and movements. On October 13, three strong patrols had been sent out on different routes by Captain Charles Archambeault of the Beauharnois militia from the advanced post at Piper's Road near the junction of the Outard and Chateauguay rivers, to approach and reconnoitre the American Camp. They all succeeded in crossing the frontier unobserved. One of them led by Lieut. John H. Powell of the 5th Battalion of Embodied Militia obtained some valuable information which has not been recorded. The other two met by previous agreement near the Douglas settlement. After dark they quietly surrounded the house of Major Smith of the New York militia. Smith and a young laborer in his employ were carried off as prisoners and questioned separately. Smith talked freely and informed them that the troops who had until then occupied Fort Hampton, had been relieved by militia. He thought that an advance would soon be made in the direction of Hemmingford but admitted that no attempt had yet been made to remove obstructions from the road. He was allowed to make his escape after they had gone about five miles and raised an alarm on returning

[1] Armstrong to Hampton, Oct. 16.

[2] Major William King (Hampton's adjutant general), to Armstrong, undated.

home. Three companies of infantry with some dragoons were sent in pursuit without result.[1]

The depredations committed at Philipsburg and Caldwell's Manor afforded an excellent pretext for the despatch of a flag of truce to General Hampton's headquarters to make a complaint. Accordingly a letter from the Adjutant General was placed in the hands of Lieut. Colonel Pierre de Boucherville, a provincial aide-de-camp to the Governor-General, with particular instructions to deliver it to him personally. Accompanied by Captain Archambeault he started from Piper's Road early on the morning of October 15. On arriving at the last settlement in Canada they made every effort to find a bye-path by which they might avoid the enemy's outposts but without success. They learned from the inhabitants that Captain Reuben Sherwood of the corps of guides had been scouting in the neighbourhood, having crossed from Cornwall, but had returned three days before. An American party had recently come over and carried off the two brothers, David and John Manning, living near by, whom they justly suspected of being British spies. On advancing by the main road they were halted near Smith's house by a double sentry post of regular soldiers. The commandant came to see them but positively refused to allow them to pass, saying that he would deliver their letters. De Boucherville declined to give them up as his instructions were to present them to General Hampton in person. A message was them sent away to the general's headquarters. While waiting for a reply, it was noticed that de Boucherville was gazing inquisitively in the direction of their encampment and he was politely requested to walk into the house with all his companions and they were thenceforth closely watched by several officers who stayed with them. Two hours later General Hampton rode up accompanied by a staff of eight officers and an escort of dragoons. He received and read the letter and promised a reply in the morning. After he had gone away six sentries were posted around the house and the two officers were kept so closely under surveillance that it was impossible for them to converse without being overheard. Next morning Archambeault was able to obtain some information respecting their artillery from an inhabitant, but their conversation was interrupted by the sudden appearance of an American officer. These extraordinary precautions were naturally interpreted to mean that some important movement was soon contemplated.[2]

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[1] Archambeault to Stovin, Oct. 14; J. S. van Rensselaer to S. van Rensselaer, Oct. 15.

[2] De Boucherville to Prevost, Oct. 17.

A letter from Colonel Pearson, received at Montreal on October 14, stated that he had been informed by a secret agent who had arrived at Prescott the day before, that six thousand men had been ordered to embark at Sackett's Harbour on the 12th in a great fleet of Durham boats and bateaux with the apparent intention of descending the St. Lawrence and forming a junction with Hampton's division for a general attack upon Montreal. As Prevost considered this a probable and practicable movement, de Rottenburg was at once instructed to equip and hold in readiness at Kingston, a small mobile column of picked troops to follow and operate on the enemy's rear as soon as their destination could be definitely ascertained. He had already written to Yeo that "it is possible General Wilkinson may look to more vulnerable points (than Kingston) and attempt forcing his way to Montreal by the St. Lawrence whilst General Hampton penetrates into Lower Canada by the Chateauguay river or else attempt carrying Prescott by a coup-de-main. In short any movement the enemy may attempt in the narrow waters will afford you a good opportunity of using your vessels and gunboats to the greatest advantage and enable you to defeat and distress either of these operations beyond measure."[1]

As an additional precaution the Seventh Battalion of Sedentary Militia was moved forward to occupy an advanced position on the Beauharnois channel from Longue Pointe to Pointe du Lac nearly opposite the Cedars. The men were quartered upon the inhabitants. A small squadron of gunboats was also sent into Lake St. Francis.[2]

James Perry, a reliable civilian agent, whose two brothers living in the State of New York near the Four Corners constantly supplied him with the latest information, reported the arrival of reinforcements of infantry with several pieces of artillery and the impressment of many waggons which had, however, been temporarily released after the arrival of an express from Sackett's Harbour. Officers had been overheard to say that they were waiting for Wilkinson's army coming down and would not move until then. If boats could be obtained, they expected that Wilkinson would come by water, otherwise, it was anticipated that their forces would form a junction near the frontier and advance by land together. In any event it was not thought probable that any movement would take place before the 26th. Most of the militia had refused to cross the line.[3]

There can be no doubt that the long-deferred advance against Montreal was actually begun in the highest spirits and with sanguine

[1] Prevost to Yeo, Oct. 13; Prevost to de Rottenburg, Oct. 14.

[2] Stovin to Prevost, Oct. 15.

[3] Statement of James Perry, Oct. 14.

hopes of success. The Aurora, published in Philadelphia, was probably the most influential and widely circulated of the newspapers supporting the government. It was edited by Colonel William Duane, the Adjutant General of the fourth military district. Duane was the author of a military manual, entitled "A Hand Book for Infantry," which had been officially adopted for the use of the army of the United States. He possessed much political influence and was on intimate terms with members of the cabinet and officers of the highest rank. Confidential information from such sources enabled him to anticipate intelligence transmitted by ordinary channels and to forecast coming events. His semi-official prediction on this occasion was entitled: "Our Armies have entered Upper Canada and it is ours."[1]

"Letters from Fort George of the 3rd October, Chateauguay of the 6th, and Sackett's Harbour of the 4th, show that the general of the enemy has found his superior in the field and been completely out-generaled. The war minister and commander-in-chief concur in opinion that in order to fell the tree, we must not begin at the top branches but strike at the stump; which discovery, it is added, had been imparted to the former Secretary of War without the least effect. By this time it is probable our troops have thrown themselves between Kingston and Montreal. The war by land has assumed a new character in consequence of the presence of able men who understand their profession, in the war department and at the head of the army. The division under General Hampton moved from Chateauguay on the morning of the 4th October, destination unknown but to himself, the troops having left behind all baggage except one change and five day's provisions, their position prior to the march not more than forty miles from Montreal. We may expect that General Prevost intends to make war like Procter at Malden and Kutusoff at Moscow, to give up everything to conflagration which he cannot rule. The ensuing week settles the fall of Upper Canada forever. The fall of Quebec in the ensuing spring will give our youth experience to ward against evils of thirty years' neglect of military knowledge. The siege of Quebec, though severe, will not be more so than the actions of our naval heroes. Canada once ours, we shall have no enemy but a few domestic traitors and foreign emissaries on our soil."[2]

This impressive utterance was immediately republished and endorsed by the National Intelligencer of Washington, the acknowledged organ of the cabinet to whose pages the President and members of the cabinet were known to contribute at times.

[1] Ingersoll, History of the War of 1812-14, Vol. I, p. 297.

[2] C. J. Ingersoll, History of the War of 1812-14, Vol. I, p. 297.

Nile's Weekly Register, of Baltimore, another widely read periodical in full sympathy with the adninistration remarked: "We look for a flood of glad tidings. Everything seems well."

General Morgan Lewis writing to his wife from Grenadier Island, said: "The prospect before us is an animating one, and, with the divine blessing, we have an almost certainty of success. Consternation prevails in the ranks of the enemy. He finds he has to contend with a foe his superior in bravery and his equal in every other requisite of a soldier. I should not be surprised if, after a feeble resistance, he were to retire to Quebec. . . . . .I hope soon to write to you from Montreal. . . . . .I do not believe we have much to apprehend beyond a few hardships."[1]

Hampton's preliminary arrangements were made with excellent judgment. As he was in a great measure dependent on that form of transport, a large number of farm waggons were hired or impressed. Expert axemen were to move with the troops to clear the roads or open new ones and rebuild bridges. Intelligent inhabitants who professed to be well acquainted with all routes leading into Canada were employed as guides. A special line of communication by means of relays of mounted messengers was established between his headquarters and Ogdensburg, where Major Parker was stationed as his representative to ensure the rapid transmission of orders and intelligence. All reinforcements that were expected had arrived. Much to his disappointment the New York militia, with a very few exceptions, had positively declined to enter Canada. He became greatly enraged at this and was reported to have declared that he would compel them to fight. They resented in turn what they regarded as "the unreasonable severity and arbitrary conduct of the general and regular officers."[2]

Since his arrival at the Four Corners the number of sick had considerably increased, and it does not appear that at any time the effective force of regular troops available for an offensive movement exceeded 4,500 of all ranks and arms. It was, however, considered sufficient to perform its share in the combined operation. A continuous forest stretching eastward for more than ten miles, the roads through which were known to be obstructed for their entire length with felled trees, was generally considered as the most formidable obstacle to be surmounted.

The march began in two columns at daybreak on October 21. That on the right composed of the élite corps of light infantry and a regiment of the line, forming the second brigade was commanded by

[1] Morgan Lewis to Mrs. Lewis.

[2] Hampton to Armstrong, Nov. 1; J. S. van Rensselaer to S. van Rensselaer, Oct. 5.

Brigadier General George Izard, a young officer of ability, who had received his professional training in Europe, and from whom much was accordingly expected. It advanced by Smith's road on the left bank of the Outard, the shortest but not the best route. Izard was directed to protect the right flank and gain the open country beyond the forest. It was also anticipated that his advance would create an alarm at St. Pierre. It was already known that the bridges over the English river had been destroyed and all roads and trails leading in that direction had been obstructed in apprehension of an attack.

The main body, headed by the First Infantry Brigade, under Colonel Robert Purdy of the 4th United States Infantry, advanced by the road along the left bank of the Chateauguay to the Long Rapids below the junction of Trout river, where it crossed the stream. It was the main travelled route in times of peace, but all bridges had been destroyed and it was everywhere obstructed by felled timber. Every building in the vicinity had been burned or pulled down to deprive the invaders of any possible shelter. Before reaching the international boundary this road passed through a dense forest and the movement was not detected by the hostile scouts until the column had actually entered Canada. Small parties of light infantry preceding it were able to make their way through the woods by paths but the labour of clearing a practicable road for carriages was very great. Izard's advance guard succeeded in surprising a party of Indians of whom one was killed. Before dark it opened communication with the head of Purdy's column, near Spear's house at the confluence of the Outard and Chateauguay where Smith's road crossed the former stream. Next day the light infantry pushed on as far as Piper's road and drove back a detachment of the Beauharnois militia, who rather precipitately abandoned a position there which had been prepared for defence. The invaders had then reached a region of comparatively open country within nineteen miles of Caughnawaga, with a fairly good road leading straight to that place, in front.

The movement of the main body, encumbered as it was with artillery and a long train of loaded waggons, was infinitely more difficult and tedious. It was closely observed by David Manning who reported the result to the commandant at St. Philippe. He counted the guns and waggons and omitted no detail that seemed important. Large working parties were constantly employed but progress was slow. The road had been so effectively obstructed that it was considered easier to cut another in a straight line through the woods than to attempt to remove the felled timber from the old one. This new route was soft and soon cut up by the train. Hampton himself started from the Four Corners on the morning of the 22nd

when his rear guard had not yet moved off. Out of 1,400 militia, it was reported that only four officers and twenty-four men had volunteered to enter Canada. They were told that General Wilkinson was coming down the St. Lawrence in boats and would join them near Montreal. Manning had also been informed that Hampton's force was already much reduced by sickness as many of his troops had been recruited in the Southern States and suffered greatly from cold. They were insufficiently clothed for the winter and overcoats had been distributed by casting lots.[1]

The two following days were actively employed by Hampton in the improvement of the road to facilitate the advance of his waggon train, composed of more than a hundred carriages. Tents were carried for his whole force with one blanket for each man and watch coats for outposts and guards.

Little has been recorded of the progress made up to this time in the construction of field works on this route of approach to Montreal. Hampton's long delay at the Four Corners was doubtless utilized for this purpose.

The piquet of local militia driven from Piper's road, retired to La Fourche where the English river flowing northward falls into the Chateauguay. This movement was at once reported by Major Henry, commanding the Beauharnois battalion, to Major General de Watteville who had recently relieved Stovin. During the night Henry was reinforced by the flank companies of the 5th Battalion of Embodied Militia under Captains Levesque and de Bartsch and two hundred men of his own corps. At daybreak Lieut. Colonel de Salaberry arrived with two companies of the Voltigeurs and the light company of the Canadian Fencibles and assumed command of the whole force. The presence of a hostile outpost or patrol was reported about two miles in front. De Salaberry had become familiar with the topography of the country during a former reconnaissance. He advanced about a mile to the nearer edge of a wide and deep ravine, intersecting the road nearly at right angles. This was chosen as the best position for the first line of resistance. The ravine itself formed a natural obstacle of some consequence and a tract of cleared land lying in a bend of the river close in front afforded an excellent though rather limited field of fire. On the right a dense, marshy thicket came within a hundred yards of the road. The Chateauguay river, forty yards wide and five or six feet deep in most places, ran three hundred yards on the left of the road and nearly parallel to its general course. Timber of a large size was abundant on the spot and large parties of the militia were at once set at work felling trees and con-

[1] David Manning to Lieut. Colonel Robertson, Oct. 24.

structing breastworks and abatis extending from the river bank along the crest across the road and some distance into the woods beyond. When this was nearly completed, a second and a third line of similar works were begun, at successive distances of two or three hundred yards, each being on the edge of a somewhat shallower and narrower ravine or coulée. Half a mile in rear of the third, another line was traced to command a practicable crossing of the stream, now known as Morrison's Ford. Among the militia were many expert and willing axemen, and, as there was no lack of tools, rapid progress was made. When these works were well advanced, thirty axemen from the Beauharnois battalion, accompanied by a covering party of equal strength from the Fencibles and Voltigeurs, were sent forward four or five miles to destroy all bridges and obstruct the road in the most favourable place by forming another line of abatis from the river to the swamp, about a mile in front of the first line. They met no opposition and saw nothing of the enemy who had apparently withdrawn their patrol. By the end of the second day all these lines were placed in a fair state of defence and a strong working party was sent across the river to construct a lunette of timber for the protection of the ford and a short line of abatis flanking the only practicable path leading to it.

By that time, Lieut. Colonel Macdonell had arrived bringing with him the battalion of light companies of the Embodied Militia ordered from Kingston and some companies of the Canadian Chasseurs and local militia. It was reported that a few pieces of light artillery were on the road to arm the fourth line.

During the afternoon of the 25th the British position was approached and reconnoitered as carefully and closely as possible without attracting attention by Major Snelling escorted by a small party of light infantry. He reported that the first line was short and nearly straight, being well covered by abatis while the woods on its right were occupied by Indians. He had been informed in some way, possibly by a deserter, that the force holding it did not exceed 350, mainly composed of militia under a militia colonel. A succession of wooden breastworks was being constructed in rear and a blockhouse was nearly completed. It was reported that the Governor General with his whole available force was advancing to oppose their further progress. After receiving this information, Hampton decided to make a resolute attempt to dislodge the force immediately in front, in the belief that if he succeeded, the position thus secured could be easily maintained until Wilkinson could co-operate. No news of the approach of Wilkinson's command had yet been forwarded from Ogdensburg and this fact caused some uneasiness.

The woods on the right of the position were pronounced impenetrable but the guides declared that a path or trail on the right bank of the river would be found practicable for infantry and the ford below was not only passable but weakly guarded as the work intended for its protection was still unfinished. By combining a stealthy turning movement along that route with a vigorous frontal attack, the force occupying the advanced lines might be expelled or perhaps cut off.

The First Infantry Brigade, composed of the 4th, 33rd, 34th, and 35th Regiments of the United States Infantry, being considered the most efficient portion of the division, was selected for the execution of the turning operation. A detachment of the élite or picked light troops was attached, making altogether a force of at least fifteen hundred of all ranks. Colonel Purdy was placed in command and instructed to cross the river at a ford near the mouth of the Outard. To ensure surprise a night march of fifteen or sixteen miles, much of the way along a narrow, winding and doubtful trail through dense woods, was deemed necessary. The movement began at sunset. Hampton accompanied the column as far as the ford. On returning to his quarters at 9 p.m. he was astonished to find an officer awaiting him with written instructions from the Quartermaster General to select a site for the construction of huts as winter quarters for ten thousand men at some suitable point on the Chateauguay river in Lower Canada. Hampton afterwards declared that this document "dashed his hopes" and raised such serious doubts in his mind of receiving "that efficacious support that had been anticipated," that he would have recalled Purdy had not the darkness and the progress he had already made put it practically out of the question. It is now known that the order upon which this letter was based was actually written by the Secretary of War the day before Wilkinson's force sailed from Henderson's Bay near Sackett's Harbour and three days before that officer was permitted to abandon his movement against Kingston and attack Montreal instead. Many years after, Armstrong attempted to justify his conduct by saying that "from the lateness of the season, the inclemency of the weather, and the continued indisposition of the commanding general," he suspected that the campaign would end as it did, "with the disgrace of doing nothing."[1]

It was still confidently expected that the turning force would reach the ford below by daybreak and begin the attack as soon as it was light enough to cross. The remainder of the division was accordingly roused at a very early hour. It was then learned with some dismay

[1] Hampton to Armstrong, Nov. 1; McMaster, History of the People of the United States, Vol. IV, 52.

that Purdy was entangled in the woods several miles from his destination. All the mishaps usually incident to a march in the dark had befallen him. Progress was very slow; halts were frequent and lengthy. By daybreak the column had not covered more than six miles. Then the guides went astray and led the advanced guard into a dense cedar swamp near the river bank, evidently thinking that they were approaching the ford. In fact they were almost opposite the first line of intrenchments. Their presence was discovered and fire opened from the other side, causing some confusion. The guides then seemed to become utterly bewildered and incapable of finding the way. For fully five hours they continued to wander vaguely about seeking a path and making little progress in the right direction.

The main body, headed by the Second Infantry Brigade under Brigadier General Izard, was soon brought to a stand by coming upon the first line of abatis where a party of axemen were at work, covered by thirty men of the Canadian Fencibles commanded by Lieutenants Guy and Johnson, who assailed the advanced guard with a brisk and effective fire. This covering party was presently driven back with some loss and a large force set at work removing the abatis and at the expense of several hours' delay a passage was opened into the clearing. The force which then debouched from the woods was roughly estimated by de Salaberry at fifteen hundred infantry and two hundred and fifty dragoons with a single field gun, while the road extending all the way back to their camp was reported to be thronged with troops and artillery.

As soon as Purdy's movement on the opposite side of the river was detected, de Salaberry became alarmed for his line of retreat and hurried back to the third line. He ordered Captains Daly, Brugière, and Tonnancour to cross the ford with their three companies of militia and occupy the abatis beyond. Returning to his former station at the first line in time to observe the retirement of the covering party, he took up a position near the centre, having Ferguson's company of Fencibles on his right and J. B. Duchesnay's company of Voltigeurs on his left. Twenty-two Indians commanded by Captain J. M. Lamothe lay hidden in the woods on the right flank, some distance in advance. The second line was held by L'Ecuyer's company of Voltigeurs and de Bartsch's company of the Fifth Battalion of Embodied Militia, having their right flank protected by a larger party of Indians. Each of the other lines was occupied by two companies, making a total force of about 400 men on the left bank and 150 on the right.

Observing that the head of the hostile column had come within range and would be exposed at once to fire from the front and flank,

de Salaberry gave the signal to begin by discharging his own rifle. This shot brought a mounted officer to the ground and was hailed by shouts from his men as a good omen. The bugle call to commence fire was then sounded. The American column quickly deployed into line to its left and fired two or three volleys into the woods. This caused a piquet of Voltigeurs which had remained outside to run rapidly inside the works. Supposing this movement to be the precursor of a general retreat, the Americans cheered lustily. The Fencibles and Voltigeurs replied in the same manner and their shouts were repeated by the companies in rear while the shrill yells of the Indians rose from their coverts in the forest. Every bugle from front to rear was sounded repeatedly with the intention of giving the enemy an exaggerated idea of the force opposed to them. These sounds were wonderfully multiplied by the echoes of the woods. Both sides kept up a brisk fire with little effect for nearly an hour but no real effort was made to penetrate the abatis or turn the position by entering the woods on its flank. The musketry gradually ceased and it became apparent that the assailants were waiting the result of their operations on the other bank. Some movement which seemed to portend an assault caused de Salaberry to sound the call to advance and Macdonell responded at once by coming forward with two companies of militia.

It was then two o'clock. Hampton had abandoned all hope of success and sent orders for Purdy to rejoin him. At this moment the sounds of conflict suddenly rose from the other side of the river. The advanced guard of Purdy's column had at length succeeded in finding the right path and approached the ford. It was surprised and thrown into confusion by a heavy volley from the companies of Daly and Brugière followed by a series of exultant yells and war-whoops, which were naturally assumed to proceed from a large body of Indians. Being assailed at the same time by a steady fire from riflemen concealed in thickets on the left bank, a rapid retreat began.

On hearing this burst of fire from the rear, de Salaberry handed over the command of the first line to Macdonell and hurried to the vicinity of the ford where he climbed a tree and shouted orders to Daly whom he instructed to reply in the same language to prevent the enemy from understanding them. Daly advanced some distance in pursuit until he encountered a formed body of troops who met him with a steady fire. He was wounded but continued to animate his men until a second and more serious wound brought him to the ground. Brugière was also disabled. Several men were killed or wounded and the rest retreated leaving a few prisoners in the enemy's hands. The path leading to the ford was left open but there was no pursuit for Purdy had received orders to fall back to a point four miles up the river

and recross it by fording. When he arrived at the place thus indicated about sunset, a message was sent to General Hampton, asking that a regiment should be ordered to cover the passage from the other side but he learned with great surprise and dismay that the whole of Izard's force had already returned to the camp. The wounded were ferried over on rafts and, as the water seemed too deep for fording, a floating bridge of logs was hastily constructed. Major Snelling crossed with one hundred picked men but this party was immediately assailed by musketry from the flank and lost several killed or wounded. Darkness had set in and the attempt to cross at this point was abandoned to avoid disaster. Snelling was ordered to make his way to the camp while Purdy retired with the remainder of his force two or three miles farther up the river and halted for the night nearly opposite to it. His troops were completely worn out and discouraged. They were unprovided with food or blankets and did not dare to light fires for fear of provoking an attack. A very heavy rain added to their misery. They lay down on their arms and about midnight were roused by the sound of firing at the outposts. They were then kept under arms until daybreak. Occasional shots from the woods kept them in a constant apprehension while the rain had rendered their own firearms wholly useless. Many of them were so thoroughly exhausted that they fell asleep standing. This firing was distinctly heard at the camp and Purdy is responsible for the statement that Hampton was so much affected by it that he said "he should be willing to compound with the first brigade for five hundred men." The river was recrossed during the morning without further loss or molestation.

These desultory attacks on Purdy's force were made by Captain Lamothe with the Indians and a few Voltigeurs. De Salaberry reported that he advanced his piquets two miles beyond the abatis.

While the action was still in progress, Sir George Prevost arrived on the field accompanied by Major General de Watteville and witnessed the retreat of Izard's brigade. The troops in advance were soon afterwards assembled and he made an inspiriting address, thanking de Watteville for his judicious arrangements and de Salaberry for his good judgment in the selection of a position and skill and courage in its defence. Several other officers were personally commended and all ranks warmly praised for their bravery and steadiness. They were encouraged to persevere in the patient endurance of hardships and privations until they could be relieved by the troops advancing to their support. Another attack might reasonably be expected which could only be repelled by their good conduct and disciplined valour. De Watteville returned to Neil Morrison's farm at St. Martine while Prevost established his headquarters at La Fourche, some distance in rear.

Fearing that a second attack might be more successful, the inhabitants on the parish of St. Martine were warned to vacate their dwellings, leaving a few trusty men behind to set them on fire when the enemy approached.

Sixteen prisoners had been taken and a few deserters also came in. The Voltigeurs, Pelletier, Vervais, Dubois and Caron, distinguhished themselves by swimming the river to receive the surrender of some of these men. Useful information was obtained from them and further evidence of panic among the enemy was supplied by the number of arms and accoutrements thrown away by them in their retreat. Six drums and one hundred and fifty stand of arms were collected.

The light company of the Canadian Fencibles which had been engaged in advance of the works lost three men killed and four wounded. Each man had expended between thirty-five and forty rounds of ammunition. No loss was sustained by any other corps on that side of the river. This is the strongest possible proof of the ineffectual character of the attack. The two militia companies actually engaged on the right bank had two men killed, two officers and six men wounded, and four men were reported as missing.

Hampton stated that his entire loss did not exceed fifty. De Salaberry conjectured that seventy were killed and a greater number wounded. This estimate is probably too large. An unofficial return, which may be accepted as approximately correct was published a few weeks later. It reported a total loss of twenty-one killed, thirty-three wounded and twenty-nine missing. Major Baker of the New York militia was named as the only officer wounded.

During the evening General Hampton received a message by express from his staff officer at Ogdensburg saying that he had not yet received any information of the movement of General Wilkinson. Four deserters came in who agreed in reporting that Sir George Prevost with three other generals had arrived at the advanced line of defence and that he was bringing forward his whole force. This information completely disheartened him. Next morning the commanding officers of brigades and corps and senior staff officers were assembled as a council of war to which the following questions were submitted: "Is it advisable under existing circumstances to renew the attack on the enemy's position, and if not, what position is it advisable for the army to take until it can receive advices of the advance of the grand army down the St. Lawrence?"

After considerable deliberation, this reply was adopted: "It is the unanimous opinion of this council that it is necessary for the preservation of this army and the fulfilment of the ostensible views of the Government that we immediately return by orderly marches

to such a position (Chateauguay), as will secure our communications with the United States, either to retire into winter quarters or be ready to strike below." Hampton concurred without hesitation. Purdy apparently acquiesced but later on bitterly criticised Hampton's conduct in an official letter addressed to Wilkinson, in which he asserted that habitual insobriety had prevented his superior from performing his duties properly.

The retreat began on the morning of the 28th but the troops only marched six miles that day, halting for the night at Piper's Road. Their movement was soon discovered and reported by Lieut. Colonel Hughes, R.E., who had gone forward to reconnoitre. Captain Lamothe with the whole body of Indians was sent in pursuit and inflicted some loss on the rear guard. The temporary bridges built by the invaders were immediately demolished by the Beauharnois militia. Next day Hampton continued his retirement to the Four Forks (Quatre Fourches), observed and harassed by a party of Indians skilfully led by Captain Dominique Ducharme, who had distinguished himself so remarkably at the action of Beaver Dams in Upper Canada, only four months before.

Hampton had conducted his retreat in this leisurely manner to re-assure his troops, give them rest and enable the stragglers, of whom there were many, to rejoin their corps. Daily marches of ten miles on the 29th and 30th enabled him to reach his former camp at the Four Corners, where he had determined to wait for further orders from the Secretary of War, who was believed to be still at Sackett's Harbour. Colonel King, his chief staff officer, was accordingly sent to that place with his official account of his unsuccessful operations, and a private letter to the Secretary requesting that his resignation, so long held in abeyance, might then be accepted. "Events have had no tendency to change my opinion of the destiny intended for me," he wrote, "nor my determination to retire from a service where I can neither feel security nor expect honor."[1]

In his official report, General de Watteville generously remarked that "Lt. Col. de Salaberry deserves much credit and my warmest commendation for the judgment and activity displayed by him in taking up and fortifying in a very short time, our advanced positions, which, together with the general good conduct of the troops engaged, caused the enemy to fail in this, his first attempt on our advanced posts on the Chateauguay river."[2]

A general order published the same day commended de Watteville for "the admirable arrangements established by him for the

[1] Hampton to Armstrong, Nov. 1.

[2] De Watteville to Prevost, Morrison's, Oct. 27.

defence of his post" and praised de Salaberry for "his judicious and officer-like conduct displayed in the choice of position and arrangement of his force."[1]

Singularly enough, de Salaberry was keenly disappointed for he considered that much more credit was due him, and he addressed a hasty and ill-advised complaint to the Adjutant General.

"The dispositions made to receive the enemy on the 26th were made by myself. No one interfered with them and no officer of superior rank came up until the action was over. It is true I was ably seconded by Lt. Col. McDonell of the Glengarry Fencibles, who had taken up a fourth position two days before, and by all the officers engaged."[2]

A sudden forward movement by Captain Pring, who advanced from Isle aux Noix to Chazy and took possession of that place with the intention of seizing a depot of stores at the Indian village, some three miles inland, miscarried from lack of co-operation on the part of the officer commanding at Odelltown, but the custom house and barracks at Windmill Point were destroyed and much alarm for the safety of the line of communication between Plattsburg and the Four Corners was naturally excited.

Martin Chittenden, the recently elected Federalist Governor of Vermont, having learned that the Third Brigade of the Third Division of the militia of that State had been ordered into the State of New York and a portion of it placed under the command of an officer of the United States Army, took this opportunity of asserting his authority by issuing an order for the immediate return of these troops to their homes where they were directed to hold themselves in readiness for service, declaring his opinion that "the military forces and resources of this State should be reserved for its defence and protection exclusively, excepting in cases provided for by the Constitution of the United States and then under orders from the Commander-in-Chief." Some officers refused to obey and a fierce war of correspondence followed.

On arriving at Sackett's Harbour, Colonel King learned with dismay that Armstrong had taken his departure for Washington more than a week before. He then decided to follow Wilkinson down the St. Lawrence and ask instructions. He overtook the flotilla about noon on November 6, six miles above Prescott, preparing to pass the British batteries at that place under cover of darkness. He candidly told Wilkinson that he carried letters from Hampton to the Secretary but had no message for him. Wilkinson had already meditated writing

[1] General order, Oct. 27.

[2] De Salaberry to Baynes, Nov. 1.

to Hampton that day, urging close co-operation, and gave King an extremely characteristic letter in which he remarked that he "was destined to and determined on the attack of Montreal if not prevented by some act of God, and to give security to the enterprise, the division under your command must co-operate with the corps under my orders." The selection of the point of junction was left to Hampton's discretion but St. Regis or its immediate vicinity was indicated as most convenient. Wilkinson added that his troops were insufficiently provided with cartridges and loose powder and had only bread for fifteen days and meat for twenty days' consumption. Hampton was accordingly requested to bring with him, or forward by the safest route, a supply of provisions for the entire force for two or three months with as much ammunition as could be furnished.[1]

King travelled rapidly and reached the Four Corners late on the evening of November 7. Hampton hurriedly consulted some of his principal officers and next day sent off Colonel Atkinson, his Inspector General, with a letter in which he declared that it would be impossible for his division to bring with it more provisions than the men could carry on their backs. "Besides their weakness and sickness, they have endured fatigues equal to a winter campaign and are sadly dispirited and fallen off," he wrote. "By falling back on my main depot where all means of transportation has gone and falling on the enemy's flank and straining every nerve to open a communication from Plattsburg to Caughnawaga or any other point you may indicate on the St. Lawrence, I should more effectually contribute to your success than by the junction at St. Regis. The way is in many places blockaded and abatised and the road impracticable for wheeled carriages during the winter but by the employment of pack horses, if I am not overpowered, I hope to be able to prevent you from starving. I have ascertained and witnessed that the plan of the enemy is to burn and consume everything in our advance."[2]

His men were undoubtedly in a wretched plight. Many of them were nearly naked and had their feet wrapped with bandages torn from blankets to supply the want of shoes. Having lost all confidence in their commander, they had become discontented and mutinous. It was currently reported that Hampton had shot with his own hand a soldier who had menaced him.[3] The retreat from the Four Corners on the road to Plattsburg was immediately commenced by brigades moving in succession at the rate of ten miles a day, quite as much as the men could march through the mud which was ankle deep. On

[1] Wilkinson to Hampton, Nov. 6.

[2] Hampton to Wilkinson, Nov. 8.

[3] Kirchberger to Drummond, Nov. 15 and 17.

the afternoon of November 14, the entire division, then reduced to less than 3,300 effectives, was again concentrated at Champlain. Fassett's brigade of Vermont militia, which had been called out for twenty days, was ordered from Plattsburg, with all the waggons at that place. A body of axemen was again assembled to clear the roads and the frontier was closely guarded to prevent the passage of spies. Macdonough's squadron advanced to the mouth of Chazy river to co-operate in the proposed demonstration.

These preparations were reported to de Watteville within forty-eight hours and Lieut. John W. Powell of the Canadian Chasseurs, who had an intimate knowledge of the country, was sent forward to reconnoitre. He ascertained beyond doubt that the camp at the Four Corners was occupied only by a guard left for the protection of the sick and wounded and burned the advanced blockhouse which was found entirely deserted.

On the evening of November 7, a disturbing report reached the Governor General at Montreal, that the American expedition coming down the St. Lawrence had succeeded in running past the batteries at Prescott during the night before. Orders were instantly sent off for the rapid mobilization and concentration of all the troops in the district for the defence of that city. The field artillery and dragoons stationed at Laprairie were directed to cross to the island of Montreal while the remainder of the force at that place advanced to Caughnawaga. The battalion of flank companies of the line, the Canadian Fencibles, four companies of the 1st Battalion of Embodied Militia and four companies of the 5th Battalion with two guns were withdrawn from their stations at L'Acadie, St. Pierre, and St. Philippe to Caughnawaga. The field works at L'Acadie were taken over by the battalion companies of the 13th. Colonel de Boucherville's battalion of militia advanced from Caughnawaga church to the support of Colonel Deschambault on the south side of the Beauharnois channel and all the Caughnawaga Indians were ordered to join him.

The alarm was spread by the ringing of church bells and firing of beacons through all the neighbouring parishes. Orders were given to complete the ammunition of all regular troops and supply the military with forty rounds for each man. Arrangements were made to provide the whole force with cooked rations for two days and biscuit for three, to be carried in haversacks. Colonel Hercules Scott, commanding at Coteau du Lac and Colonel Deschambault at Beauharnois were ordered to oppose the enemy's progress by every practicable means and in the event that the American boats succeeded in passing their posts, they were directed to retire upon Montreal with the regulars and all the militia who would accompany them. A

detachment of the 1st Battalion of Royal Marines whose arrival at Three Rivers had been reported, was ordered forward by forced marches.

The sedentary militia of the district responded to the call not only with alacrity but enthusiasm. A vivid account of the scene presented by these battalions while on the march has been recorded by an eye witness.

"We came up with several regiments of militia on their march. They had all a serviceable effective appearance—had been pretty well drilled, and their arms, being directly from the Tower, were in perfectly good order, nor had they the mobbish appearance that such a levy in any other country would have had. Their capots and trowsers of homemade stuff and their blue *tuques* (nightcaps), were all of the same cut and colour which gave them an air of uniformity which added much to their military look, for I have always remarked that a body of men's appearance in battalion depends much less on the position of their military dress and appointments than on the whole being in strict uniformity.

"They marched merrily along to the music of their *voyageur* songs and as they perceived our uniforms as we came along, they set up the Indian war whoop, followed by a shout of *vive le Roi* along the whole line. Such a body of men in such a temper and with so perfect a use of their weapons as all of them possessed, if posted on such ground as would preclude the possibility of regular troops out-manœuvring them (and such positions are not hard to find in Canada), must have been rather a formidable body to have attacked."[1]

Inside of twenty-four hours the steamboat and several schooners arrived from Quebec having on board Lieut. General Drummond, Major General Riall, a rocket company of the Royal Marine Artillery, and 350 seamen of the Royal Navy commanded by Captain Stephen Popham. The detachment of Royal Marines from Three Rivers marched in the same evening and were granted a day of rest before joining the remainder of the battalion at Lachine. Drummond was given command of all troops on the south side of the river with head-quarters at Chateauguay. Riall was put in command of all on the north side between the Cedars and Cornwall. The sedentary militia which had assembled in great numbers were formally inspected by Prevost on the Champ de Mars on the afternoon of the 11th, and he then transferred his headquarters to Lachine. The division of gunboats on Lake St. Francis was manned by the seamen under Popham, who was placed in command.

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[1] Dunlop, Recollections of the American War of 1812-14, pp. 13-14.

Early on the morning of the 12th, the day after the hard-fought action at Chrysler's Farm, Wilkinson's flotilla again got under way, passed down the Longue Sault and came up with their advanced guard, which had halted at Barnhart's, within a few miles of Cornwall. Colonel Atkinson arrived and delivered Hampton's letter. A perusal of this in conjunction with Atkinson's verbal account of the demoralized state of that division completed Wilkinson's discomfiture. He resorted to the usual expedient of assembling a council of war composed of the general officers and the colonel in command of the élite, which found little difficulty in arriving at the unanimous opinion that "the attack of Montreal should be abandoned for the present season and the army should be immediately crossed to the American shore for taking up winter quarters and that this place afforded an eligible position for such quarters."[1]

At noon on November 14, Prevost was informed of the favourable result of the action and that the American force had crossed the river on the evening of the 13th to the vicinity of St. Regis. He also knew that Hampton was moving in the direction of Champlain. Lieut. Colonel Morrison was at once ordered to advance with his column and join Colonel Scott at Coteau du Lac while Captain Mulcaster was directed to unite with Popham, take command of the whole squadron of gunboats and lose no opportunity of harassing and damaging the hostile flotilla, but as it was soon learned that it had taken refuge several miles up the Salmon River, nothing beyond a close blockade seemed practicable.

Hampton received official notice of Wilkinson's arrival at French Mills and his decision to abandon a further advance, on the afternoon of November 14. He lost no time in countermanding his orders for the movement of troops from Plattsburg and began his march into winter quarters at that place early next morning but encountered a storm of wet and drifting snow which added much to the wretchedness and demoralization of his unfortunate troops.

Reports from officers engaged in reconnaissance combined with those of secret agents were so definite and agreed so thoroughly in the opinion that both divisions of the enemy's force were moving into winter quarters that Prevost at once decided to make a fundamental redistruibtion of his own troops for their health and comfort.

The 2nd Battalion of Royal Marines and the company of Royal Marine Artillery were sent to strengthen the garrison of Prescott while the 2nd Battalion of the 89th with a detachment of De Watteville's moved by easy marches to Kingston. Four companies of the Canadian Fencibles were stationed at Cornwall to protect the line

[1] Wilkinson to the Secretary of War, Nov. 16.

of communication from the River Raisin to the foot of the Longue Sault; the remainder of that corps was quartered at St. Philippe and St. Pierre. The 49th and Canadian Voltigeurs marched from Coteau to Montreal; the 1st Battalion of Royal Marines were transferred from Montreal to Isle aux Noix to relieve the detachment of the 13th and the whole of the latter regiment was concentrated at St. Jean for the winter. The right wing of the Regiment de Meuron relieved the sedentary militia from duty at Montreal and the left wing was stationed at Chambly. The flank companies of regiments of the line and embodied militia, provisionally organized into battalions were ordered to rejoin their corps. One brigade of field artillery was quartered at Longueuil, another at Chambly; the reserve and headquarters at Montreal. The battalions of Embodied Militia were distributed in the following manner: 1st Battalion at Laprairie; 2nd Battalion at Chateauguay and La Fourche; 3rd Battalion at Yamaska and Beloeil; 4th Battalion at St. Jean, L'Acadie, and in advance of the latter post; 5th Battalion at Lachine, Coteau du Lac and the Cedars. The Frontier Light Infantry occupied Odelltown and its vicinity. The headquarters and two troops of the 19th Light Dragoons were stationed at Laprairie; one troop was at the Halfway House; another at Chambly. Captain Watson's troop of Dorchester Provincial Dragoons was quartered at St. Jean and furnished despatch riders for L'Acadie and Chateauguay. The company of Guides was billetted at Laprairie and supplied couriers on the line of communication between St. Anne and Montreal.

Six gunboats of the row galley pattern had been conveyed from Sorel to Isle aux Noix upon large trucks specially built for the purpose. Three of them were armed with one long 24 pounder in the bow which could only fire on a line with the keel, and a 32 pounder carronade mounted on a traversing carriage in the stern which could be laid in almost any direction. The others were armed only with a 24 pounder in the bow. Each of them required a crew of from thirty to fifty according to its size.

Captain Pring was directed to make an extensive reconnaissance on Lake Champlain with the sloops and as many gunboats as could be manned. Moving from Isle aux Noix on the morning of November 17, he sent forward his gunboats to observe the shore from Champlain to Chazy. A landing was effected at each of those places without opposition and it was ascertained beyond doubt that Hampton's whole force had retired to Plattsburg where the American squadron was moored in the harbour under the guns of a battery.

Patrols were pushed forward from Odelltown and Chateauguay to Champlain and the Four Corners and the vicinity of the French

Mills and their reports combined with those of spies who had penetrated the American lines made it quite certain that all thought of resuming the offensive had been abandoned. All accounts agreed in representing that the spirits of their troops were much depressed and that discontent was prevalent. An officer of the Voltigeurs, bearing a flag of truce was detained at the outposts and thus prevented from obtaining any information of much value. Finally Lieut. Colonel de Salaberry was instructed to attempt the surprise of the outpost at the Four Corners with three hundred Voltigeurs and militia accompanied by twenty-five troopers of the 19th Dragoons. At the end of the first day's march it was found that the horses had not been properly shod for this service and the dragoons were sent back. De Salaberry continued his march with the remainder of the force. After arriving within fourteen miles of his destination, a heavy rain set in and the weather turned very cold. On halting for the night it was reported that three men had deserted, presumably to the enemy. The rain continued without intermission until morning when he decided to return. 'The force under my command," he wrote in evident ill-humour, "was out three days, always in the woods and morasses and up to our knees in mud and water and drenched through with heavy rains." Their sufferings were great and he regained his camp at Chateauguay in a state of extreme exhaustion, complaining that his men were nearly naked and quite worn out by needless fatigue and hardships. Another officer who had gone on horseback as far as the frontier by a different road reported that "the mud among the logs and tree-roots was nearly belly-deep."[1]

Had de Salaberry succeeded in this enterprise it was de Watteville's intention to support him immediately with a thousand men and thus make an effective diversion in favour of a combined naval and military expedition operating from Cornwall and Coteau under Sir Gordon Drummond which had been strongly advocated by Captain W. H. Mulcaster. On arriving at Cornwall and enquiring into his means, Drummond soon came to the conclusion that the force at his disposal was entirely inadequate to accomplish such an ambitious undertaking and recommended that "instead of risking the loss of any portion of it, steps should be taken to nurse them, particularly our seamen, for efficient offensive operations as early as possible in the ensuing spring."[2]

Colonel Hercules Scott, who was still in command at Coteau, proposed, and received the rather reluctant consent of Prevost to

[1] Drummond to Prevost, Nov. 23; General order, Nov. 25; C. M. de Salaberry to de Rouville, Nov. 26; C. M. de Salaberry to L. de Salaberry, Dec. 5; Milne to de Salaberry, Nov. 26.

[2] Drummond to Prevost, Nov. 30.

adopt, a plan for encouraging desertion among the troops encamped at the French Mills who were unquestionably extremely dissatisfied and wretched. Deserters who had recently come in reported that all the soldiers had seven months' pay due them and many were only deterred from leaving by the hope of receiving these arrears. They were still in tents waiting for lumber to arrive for the construction of huts, and being unprovided with any kind of winter clothing, their sufferings were great. Handbills were accordingly prepared and circulated in the camp or posted in the immediate vicinity, offering payment of five months' arrears to all deserters who would report at the British outposts. A trail was blazed through the woods to a secluded landing place on the St. Lawrence, where a supply of provisions was deposited and a boat kept in readiness to ferry them over.[1] This scheme was attended with some success and the number of deserters, who came in, materially increased. Wilkinson sent off his dragoons to winter at Greenbush and Pittsfield and thus considerably diminished the quantity of supplies required. His force which numbered quite nine thousand when it sailed from Sackett's Harbour was reduced by deaths, desertions, discharges and sickness to less than six thousand effectives at the end of November. His flotilla, consisting of two sloops, thirteen gunboats and upwards of one hundred bateaux, and Durham boats ascended the narrow, sluggish stream called Salmon River for about eight miles where these craft were anchored or drawn up on shore under the protection of a large blockhouse and several batteries armed with the heavy guns intended for the siege of Montreal. Three separate encampments occupied by five thousand men were formed within musket shot. The remainder were quartered at Malone and the Four Corners.

Mulcaster's proposal for a general attack having been rejected, Midshipman John Harvie offered to attempt the destruction of some of the largest boats with explosives. He was accordingly provided with three carcasses and set out in a canoe on the night of December 1, accompanied by seaman George Barnet. Paddling silently up the Salmon River, they succeeded in passing the American outposts without being observed and Harvie had actually placed one of the carcasses on board a gunboat when the cracking of the ice alarmed a sentry. A guard boat was sent out and twice passed close to his canoe without discovering it, but he was forced to abandon the attempt and make his escape.

Two days later a party of deserters came into the outpost at Glengarry House. One of them, who declared that he was of English

[1] Scott to Prevost, Nov. 26; Prevost to Scott, Nov. 27; Major J. P. Fulton to Prevost, Dec. 5; Handbill printed in Lossing's Field Book of the War of 1812, p. 658.

birth, offered to conduct a party to blow up the principal magazine which he described as being carelessly guarded as it was situated near the centre of the camp. Midshipmen Harvie and Hawkesworth and seaman Barnet immediately volunteered for this desperate enterprise. They were supplied with combustibles and landed by night on the American shore. After remaining for several days concealed in the woods, waiting for a favourable opportunity to accomplish their purpose, they learned that the magazine was being more closely guarded than had been reported. Unwilling even then to abandon the attempt, Harvie entered the camp in disguise and remained there for two whole days, during which he obtained information which might have enabled him to destroy the magazine, had he not been betrayed by his guide. He was then in great danger of being taken and executed as a spy. "The adroit manner in which he effected his escape," Mulcaster wrote, "can only be equalled by his previous determined resolution." He was immediately promoted to the rank of lieutenant by Sir James Yeo, who, when announcing this to his command in a special order, took the opportunity of informing his officers that promotion would always depend "on their zeal and exertions and good conduct."[1]

On December 4, Captain Pring again entered Lake Champlain with six galleys. A lookout boat, which had been posted near the mouth of the river, made off rapidly at his approach. Following in pursuit to the neighbourhood of Plattsburg, a landing was made on Cumberland Head, where a large public storehouse and some boats were burned. A quantity of round shot and provisions was brought off. The smoke gave the first warning to Macdonough of his movement. Four galleys, followed at some distance by the same number of sloops, got under way, all of them being propelled by oars as the weather was dead calm. It had turned cold and ice was rapidly forming in the shallow water. Pring decided to decline an action and return without delay to his station. He was eventually obliged to cut a channel in the ice for several miles to permit the passage of his boats. Macdonough pursued for some distance and expressed great surprise because his adversary refused to fight as he believed him to be superior in both guns and men.[2]

By this time a vague report had reached the American commander on the lake that a brig to carry twenty-four guns had been laid down at Isle aux Noix and in mentioning this, he threw some curious light on his situation by remarking: "It is extremely difficult to get in-

[1] Mulcaster to Prevost, Dec. 4; Mulcaster to Yeo, Dec. 20; Yeo, General order, January 1, 1814.

[2] Pring to Prevost, Dec. 5; Prevost to the Duke of York, Dec. 12; Macdonough to the Secretary of the Navy, Dec. 5.

formation of the enemy's doings as none but smugglers are permitted to be in the vicinity of Isle aux Noix where they carry on their operations, and this smuggling is so systematised, I have reason to believe, by the Government of Canada, that nothing is to be obtained from them. On the contrary, their information is to be guarded against."[1]

Izard, who had then succeeded Hampton in command at Plattsburg, advised that the squadron should be laid up for the winter in Otter Creek, near the village of Vergennes, as the best place for procuring the necessary materials for the construction of more ships and Macdonough proceeded to that place about the middle of December with all his vessels.[2]

Wilkinson's troops had manifestly become unfit for active operations and were soon abandoned by him and most of the other generals, who took an early opportunity to find more comfortable quarters or to visit their homes. During the whole of October and the first two weeks of November, the greater part of them had been subjected to incessant fatigue and much of the time exposed in open boats to wind, rain and snow. After arriving at the place selected for their winter quarters, the weather turned very cold and stormy. Many of them had lost their blankets and overcoats. Even the sick had no shelter except tents until the beginning of January, as lumber for building huts could not be procured. Provisions were scanty and of the worst quality. Medicines and other hospital stores had been lost or destroyed. The morning report of one corps showed seventy-five sick out of a total of one hundred and sixty present. Other regiments reported a proportionate number unfit for duty. The adjacent country was almost an unbroken wilderness. Huts and warm hospital buildings were absolutely necessary to save the wretched remnant of this force from perishing. The construction of quarters in such a place was a task of great labour and occupied many weeks. Hospital stores of any description could not be obtained nearer than Albany, a distance of 250 miles. Provisions and forage had to be hauled over a scarcely passable road from Plattsburg. The want of all kinds of supplies was severely felt. Bread of a very inferior quality was the principal article of food, issued for nearly seven weeks. The number of sick constantly increased. Eventually the arsenal, academy and several dwellings at Malone, eighteen miles away, were converted into temporary hospitals for 450 of the most serious cases. The sickness and sufferings of this army and the large number of deaths, which were by no means understated in the accounts published by Federalist newspapers, excited much alarm and indignation throughout

[1] Macdonough to the Secretary of War, Dec. 9.

[2] Macdonough to the Secretary of the Navy, Dec. 18, 21, and 28.

the United States. The management of the hospitals and the quartermaster's department was bitterly criticised. By the 1st of February, the hospitals at Malone were crammed and no accommodation could be found for two hundred very sick men, sent forward from the camps without notice. Four of these miserable men actually died from exposure on the road. Two-fifths of the entire force were then reported unfit for any service. The abandonment of this ill-chosen position had become inevitable to preserve the health of the remainder.[1]

Between the 12th and 16th of February, the camps at the French Mills and Four Corners were evacuated. The barracks and blockhouses which had been constructed with much labour and at great expense were partially burned and the large flotilla of gunboats and small craft was similarly damaged as much as its situation in the ice would admit. Some of the heaviest guns of the siege train were buried and the remainder removed together with the greater part of the stores and provisions. When this movement became known at Montreal instructions were given to Colonel Scott to advance from Coteau with a light column of picked troops, composed of detachments of Royal Artillery, the 19th Light Dragoons, 89th, 103rd, Canadian Fencibles, 5th Embodied Militia, and Glengarry and Stormont Militia, numbering 1,308 of all ranks. This force was conveyed in sleighs across the St. Lawrence on the ice on the morning of February 19 and reached the French Mills in time to obtain contact with the rear guard of the American division. A considerable number of soldiers were taken prisoners at that place and Malone, being chiefly men who were too sick to be removed. They were paroled together with their attendants and a number of inhabitants who had been enrolled in the militia. Detachments were sent to Madrid, Hopkinton and other villages where considerable quantities of flour and salted meat were seized. A reconnoitering patrol advanced within four miles of Plattsburg, and at the crossing of the Au Sable captured a courier bearing important despatches. It was ascertained that two infantry regiments from the camp at the French Mills had gone to Sackett's Harbour and the remainder of that division to Plattsburg, where the number of troops was estimated to amount to 5,000 with 4,000 at Burlington. General Wilkinson had established his headquarters at Plattsburg.

The destruction of the barracks, blockhouses and boats at the French Mill, and Malone was completed. Teams and sleighs were impressed from the inhabitants and a hundred loads of provisions and stores were brought off. Scott then proceeded to the Four Corners where he was joined by a party of Indians from Lower Canada who

[1] Mann, Medical Sketches of the Campaigns of 1812, 1813, 1814, pp. 116-127.

had ascended the Chateauguay river. The barracks were destroyed and he returned to Coteau on February 24. Not less than ninety men were lost through desertion on this expedition, of whom fifty-one belonged to the 103rd and twenty to the Canadian Fencibles. This was angrily attributed by General de Rottenburg, who had again assumed command at Montreal, to "the want of activity and exertion" on the part of their officers as the dragoons and Indians might have been employed to prevent desertion. Prevost indignantly remarked that "unfortunately several of the corps last sent to this country have brought with them a very bad description of men—men who have long lost sight of every thing that is honest and honourable. Convicts taken from the hulks to be made soldiers, but who answer no other purpose than that of bringing the profession into discredit and disrespect. The 103rd Regt. come most under that description."[1]

[1] De Rottenburg to Brenton, Mch. 2, 1814; Prevost to Bathurst, Mch. 10 and 12; Hough, History of St. Lawrence County, N.Y., p. 323.

Mémoires de la Société Royale du Canada
SECTION I

Série III | SEPTEMBRE 1914 | Vol. VIII

La Noblesse au Canada avant 1760.

Par M. Benjamin Sulte.

(Lu le 26 mai 1914)

Voici, peut-être, le sujet le moins compris de l'histoire du Canada. A part le nombre restreint des gens instruits, libres de préjugés et recherchant les choses d'autrefois sans y vouloir introduire les us et coutumes de notre temps, il règne, en général, dans le milieu canadien-français et ailleurs une impression défavorable à l'ancienne noblesse de ce pays. Cela est dû au fait incontestable que le siècle dernier n'a vu que la décadence de ce groupe qui avait été par moments le plus notable de la Nouvelle-France, aussi bien que durant les quarante premières années du régime anglais.

La présente étude commencera vers 1660 pour se terminer aux alentours de 1760.

Un état de société ancien et disparu—le Canada avant 1760—ne saurait être défini tel qu'il existait sans de copieuses explications écrites ou parlées clairement, de manière à faire comprendre chaque point du problême, car c'est pour nous tout un autre monde.

Sans avoir étudié la noblesse canadienne du XVIIème siècle, plus d'une personne se dira, en voyant cet article: "Il n'y a pas de quoi, je sais ce qu'était la noblesse"—et des visions de France ou d'Angleterre lui passent par la tête.

Faites attention! Je m'occupe du Canada et pas du tout de l'Europe. Etes-vous certain que vous avez des idées justes sur les nobles du temps de Frontenac et de Vaudreuil, par exemple, ou encore sur les éléments qui composaient les cinq ou six classes de la société canadienne à l'époque de Talon, ou durant les dix-huit années de Beauharnois? Cela couvre plus de quatre-vingts ans qui ne ressemblent en rien aux choses d'aujourd'hui. Je vais vous introduire dans ce milieu, afin que vous puissiez vous rendre compte du tableau qu'il présentait au général à ceux qui l'ont vu.

Il est rare que l'on parle des origines de la race canadienne sans mentionner la noblesse. Les étrangers se plaisent à dire que le Canada

était sous la dépendance de la classe privilégiée, ce qui implique d'une part les jouisseurs et, à côté, les travailleurs. La malice et l'ignorance ont beau jeu avec une telle supposition.

La vérité est que nous étions comme les Français de France, et cependant moins qu'eux, soumis à une forme de gouvernement arbitraire et aveugle, mais notre noblesse n'y comptait pour rien. Elle était sans privilège. Sa situation se trouvait plutôt vague, tandis que le cultivateur, le bourgeois, le fonctionnaire civil se voyaient dans un état parfaitement défini.

I

D'après l'acte de 1598 qui est notre point de départ, il est visible que Henri IV concevait la création d'une noblesse canadienne, en dépit du fait que le Canada ne renfermait pas un seul colon. Les choses n'étaient pas mieux en 1627, lorsque Richelieu, établissant la compagnie des Cent-Associés promettait de faire anoblir quelques uns de ses membres.

Avant que d'envoyer des défricheurs abattre la forêt et des laboureurs pour faire naître la subsistance de l'homme; avant que de construire la maison, on eut l'idée étrange d'entreprendre la toiture et de distribuer des patentes de seigneurie, baronnies, etc., pour représenter une population de castors et d'orignaux.

Sur ce principe, en 1624, alors que les deux de Caen avaient en mains la traite des pelleteries du Saint-Laurent, et avant l'apparition d'une seule charrue à Québec, Louis XIII donna à Guillaume de Caen le Cap Tourmente, l'île d'Orléans et autres îles du voisinage comme fief noble. Une petite ferme, quelques têtes de bétail rassemblées au pied du cap en question furent toute l'entreprise noble de ce brave marchand, qui perdit ses terres et son titre pompeux en 1627 par suite de la formation de la compagnie des Cent-Associés.

La clause XVI de l'acte d'établissement des Cent-Associés, signé le 27 avril 1627 dit: "En cas que, du nombre des dits associés, il s'en rencontre quelqu'un qui ne soit pas d'extraction noble, Sa Majesté anoblira jusqu'à douze des dits associés, lesquels jouiront à l'avenir de tous privilèges de noblesse, ensemble leurs enfants nés ou à naître de leur loyal mariage". Quelques uns de ce douze furent anoblis dès le mois de janvier suivant. Il n'y a nulle apparence qu'aucun d'eux soit jamais venu au Canada.

A la date de la mort de Champlain (1635) il y avait à Québec un gentilhomme du nom de Marc-Antoine Brasdefer, écuyer, sieur de Châteaufort qui prit la direction des affaires en attendant des ordres de la cour de France.

On peut dire que le pays était sans population blanche, néanmoins, parmi les quelques hommes déjà "habitués" il faut citer Guillaume

Couillard, Jean Godefroy, Jacques Hertel, Robert Giffard, Jean Juchereau, Pierre Boucher qui furent anoblis plus tard. C'étaient des gens de métier, cultivateurs, interprètes par occasion, faisant le trafic des fourrures pour le compte des compagnies privilégiées, tous suffisamment instruits, de conduite exemplaire et, en somme, selon les idées de Champlain, qui, on le sait, repugnait à voir autour de lui des caractères d'aventuriers. Du même type, mais qui n'entrèrent point dans la noblesse, on peut citer Louis Hébert, Olivier Le Tardiff, Thierry Desdames, Pierre Desportes, Adrien Duchesne, Jean Lespinasse, Jean Nicolet, Abraham Martin, Nicolas Marsolet, tous hommes de valeur et de bonne vie. Ce petit nombre composait à peu près toute la population stable.

Jacques Gourdeau sieur de Beaulieu, du Poitou, parait être venu en 1636. Il devint seigneur à l'île d'Orléans.

Avec l'année 1636 commence la noblesse au Canada, par l'arrivée de deux familles apparentées: Le Gardeur et Le Neuf, formant un groupe de quarante-cinq personnes, toutes de Normandie. Les deux frères Le Neuf étaient nobles, mais nous ne connaissons pas la date de leur première patente à cet égard. Les deux frères Le Gardeur remontaient à 1510.

Jacques Le Neuf arrivait porteur d'un titre de concession de terre qu'il nomma Portneuf (comté de Portneuf à présent), qu'il passa, plus tard, à son gendre René Robineau et que celui-ci fit ériger en baronnie. Un autre terrain accordé à ce même Le Neuf, aux Trois-Rivières, reçut le nom de marquisat Du Sablé mais on ne connait rien de cette dernière création. Tant que dura le régime français, les descendants de Le Neuf restèrent en vue dans le Canada et en Acadie, comme marchands de fourrures, militaires et colonisateurs.

Les Le Gardeur ont une histoire à peu près semblable dans toute la Nouvelle-France.

Un autre noble, François de Chavigny sieur de Berchereau, de la Champagne, arrive en 1640 et s'établit à l'île d'Orléans, où il eut une seigneurie que sa veuve, Eléonore de Grandmaison, fit valoir durant de longues années.

Notons que Charles Le Moine, de Normandie, arriva aussi en 1640. On sait qu'il fut anobli et que ses enfants—Bienville, Sainte-Hélène, Maricourt, d'Iberville, etc., ont une place brillante dans l'histoire de leur temps.

Louis d'Aillebout sieur de Coulonge, noblesse de Champagne, arriva en 1643 intéressé dans la colonie de Montréal. Il succéda plus tard à M. de Montmagny comme gouverneur-général. La famille s'est perpétuée en Canada par son neveu, Charles d'Ailleboust des Musseaux—c'étaient tous des militaires.

On place en 1645 l'arrivée de Louis-Théandre Chartier de Lotbinière dont la noblesse date de 1374.

Nicolas Denys de Vitré était en Acadie dès 1632. Il y joua longtemps un rôle considérable. Son frère, Simon Denys de la Trinité, se fixa à Québec vers 1649. Ils venaient de Tours et comptaient parmi la noblesse. Leur esprit entreprenant se continua par leur descendance.

Les D'Amours, qui figurent à Québec en 1651, étaient nobles depuis 1489. On les rencontre partout dans nos annales.

C'est en 1652 qu'arriva Charles Aubert de la Chesnaye, marchand et homme d'influence, anobli en 1693. Des trois branches de sa famille, mentionnons celle de Gaspé qui nous a donné un délicieux écrivain.

En 1655, Louis Rouer de Villeray était à Québec. Homme de loi, on le retrouve au Conseil Souverain mêlé à tous les débats d'un demi-siècle. C'était de la noblesse de Lombardie renouvelée en France Il venait d'Amboise, dans la Touraine.

Le sieur Muis d'Entremont, passant en Acadie (1651) reçut une concession de terre érigée en baronnie et c'est pourquoi ce seigneur est presque toujours appelé baron de Pobomcoup. Le Canada n'avait aucune seigneurie titrée, sauf celle des sieurs de Caen à peine digne de mention puisqu'il n'en résulta jamais rien.

Le 9 avril 1656, la compagnie des Cent-Associés érigea la terre de Coulogne en châtellanie en faveur de Louis d'Ailleboust. L'affaire resta sur le papier, car d'Ailleboust se gardait bien de faire les frais d'une installation qui lui aurait, de plus, imposé des dépenses constantes. La propriété en question est aujourd'hui *Spencer Wood*, résidence du lieutenant-gouverneur de Québec.

Un marchand de Rouen, du nom de Jacques Le Ber, qui était établi à Montréal dès 1658 devint un citoyen notable et fut anobli en 1696.

II

Nous ne possédons pas encore les moyens d'écrire l'histoire de chaque famille noble, ni les connaissances suffisantes pour choisir parmi tant de noms en apparence nobles ceux qui avaient droit à cette qualité. L'homme le plus riche du monde ne peut donner que ce qu'il a, cependant, tout incomplets que puissent être nos renseignements, si on les compare aux chiffres de la population, il faut croire que nous avons ci-dessus un nombre assez élevé d'individus remarquables pour une toute petite colonie qui commençait sous de fâcheux auspices. Le lecteur connait la signification du terme "les temps héroïques" appliqué à notre pays, de 1636 à 1663. On pourra consulter, au cours de cette étude, le tableau suivant:

1640	près de	300	âmes
1660	"	2,000	"
1673	"	6,700	"
1675	"	7,800	"
1681	"	10,000	"
1698	"	15,000	"
1728	moins de	20,000	"

Nous ne dépasserons guère l'année 1720 pour les détails parceque lesquarante années qui suivent ne nous apprendraient rien de nouveau.

Ainsi donc, cet aperçu des recensements fera voir que si nous n'avons pas des centaines de familles nobles à mettre en scène, nous en avons certainement beaucoup plus qu'on ne l'imaginerait en voyant le bas chiffre de la population à toutes les époques. Résumons:

1636	Le Gardeur, Le Neuf.
1640	Chavigny.
1643	d'Ailleboust.
1645	Chartier.
1649	Denys.
1651	D'Amours.
1655	Rouer.

Comme il faut compter deux Le Gardeur, deux Le Neuf, deux d'Ailleboust, deux Denys, deux D'Amours, nous avons treize familles nobles venues de France (et probablement plus) pour 2,000 âmes. A part cela, nous connaissons au moins vingt familles qui constituaient la classe bourgeoise. Quant à la masse du peuple c'était des cultivateurs. Autant d'états, de professions, de métiers qu'il en fallait, nous les avions—mais pas de troupes militaires et cependant on en avait grandement besoin.

Tous les écrits du temps sont remplis d'une clameur: des troupes! Le jeune roi Louis XIV y prêta attention et l'idée lui vint de s'occuper du Canada. C'était en 1660.

Nous avions cru, jusqu'à l'année dernière que de cette bonne résolution du monarque datait son désir de récompenser par des lettres de noblesse les Canadiens méritants, mais cette faveur avait déjà été accordée par deux fois en pleine administration du cardinal Mazarin. Les fils de Guillaume Couillard—Louis de l'Espinay et Charles des Islets de Beaumont—s'étaient vus appelés au rang des nobles en 1654. Leurs lettres-patentes, adressées au parlement de Paris, n'avaient pas été enregistrées et ne le furent qu'en 1675, à Québec, sur un ordre du roi.

Robert Giffard eut son tour en 1658 et le gouverneur d'Argenson fit enregistrer la pièce à Québec, sans délai.

Il est probable que Jean de Lauzon s'était chargé du soin de ces deux affaires. En tous cas, une troisième eut lieu par son entremise en faveur de Pierre Boucher (1661) mais les lettres demeurèrent à Québec sans être enregistrée et elles périrent par accident. Il fallut les renouveller longtemps plus tard.

Le voyage en France de Pierre Boucher, en 1662, produisit un bon effet. Il revint avec des colons et deux ou trois compagnies de volontaires dont l'un des officiers, Etienne Pezard de la Touche se fit cultivateur et fonda la seigneurie de Champlain près Batiscan, en 1664. Il était de la ville de Blais et possédait des moyens.

Jusqu'à la date où nous sommes parvenus, les nobles venaient de France de leur propre initiative et j'ose dire que ces quatorze ou quinze familles n'étaient point dans la détresse, et encore mieux, que leurs descendants ont tous plus ou moins prospéré.

Maintenant nous allons voir arriver la noblesse envoyée par le roi, et avec elle la misère.

Les nobles de France déjà anciens dans la colonie ne portaient pas les armes, mais s'occupaient de leurs affaires et s'en trouvaient bien.

Je me figure que le roi, apprenant cette bonne nouvelle, s'est dit: "Puisque la noblesse prospère en ce pays-là je vais lui en envoyer!"

Et il porta son choix sur les militaires sans fortune, ne se rendant pas compte de la différence qu'il y avait entre les hommes qui, autrefois s'étaient choisis eux-mêmes et ceux qu'il allait choisir. De cette erreur est né le grand cri de détresse que je tâche de ramener à sa source, car ni les nobles de France antérieurs à 1660 ni la noblesse de souche canadienne n'ont guère eu à souffrir, en aucun temps, mais les officiers d'épée n'étaient pas aussi heureux.

Les officiers venus en 1665 avec le régiment de Cariguan devaient tous appartenir à la noblesse puisque c'était la règle invariable ou très peu variable. Ceux dont les noms suivent ont été seigneurs et militaires au Canada. Je les cite parceque nous avons la date de leur noblesse:—

Saint-Ours 1314. Joybert de Soulanges 1350. Gautier de Varennes 1354. Villieu 1628 en Savoie et 1662 en France. Pécaudy de Contrecœur 1661.

Il en est resté plusieurs autres en Canada qui ont plus ou moins prospéré. Voir Société Royale 1902, p. 25.

III

Le Conseil souverain de Québec établi en 1663 ressemblait au parlement de Paris. Il exercait les fonctions législatives et judiciaires et servait de bureau d'enregistrement. C'était le siège du gouvernement de la colonie, en tenant compte des attributions du gouverneur-général et de celles de l'intendant. Vers la fin du siècle, le roi changea son nom en Conseil Supérieur.

En 1667 le Conseil prend connaissance des titres de noblesse de Le Gardeur, constatant qu'ils sont de 1510 et ont été enregistrée en Normandie l'année 1556.

Une lettre du roi du 16 mars 1668, adressée au parlement de Paris renouvelle la noblesse de Louis et Charles Couillard, mais ce document n'est pas enregistré de suite au Conseil de Québec; il le sera en 1675.

Talon écrit (1668) à Jean Godefroy que le roi l'honore de lettres de noblesse. Plus tard, on sut que le parlement de Paris les gardait sans les enregistrer.

Charles Le Moine ne fut pas plus heureux, car ses lettres de 1668 restèrent à Paris et il était mort lorsqu'on parvint à les enregistrer à Québec.

Jacques Fleury sieur d'Eschambault nouvellement arrivé au Canada, remontait par sa noblesse à 1550. Je n'en ai pas vu l'enregistrement. Il était du Poitou.

Nicolas Dupont sieur de Neuville qui demeurait à Québec en 1669 obtint, l'année suivante, des lettres de noblesse qui furent enregistrées à Québec sans délai.

Le sieur Jean-Vincent-Philippe de Hautmesnil natif de Rouen, demeurant à Montréal, étant "repassé en France pour s'y marier, demanda la confirmation de la noblesse déjà accordée, en 1654, à son père Pierre-Philippe de Marigny. Il lui fut répondu que le roi confirmerait sa noblesse lorsqu'il serait repassé en Canada avec sa famille et, en effet, par ses lettres patentes, ce prince exigea sa présence dans ce pays comme condition rigoureuse de la continuation de cette grâce." (Faillon).

C'était déjà assez curieux de voir les bureaux du roi adresser au parlement de Paris des pièces appartenant au Canada, mais la conduite du parlement qui met ces écrits aux oubliettes, au lieu de les renvoyer à leur auteur ne s'explique pas. Peut-être était-il de règle, dans le siècle de l'étiquette et de la routine, de ne jamais rendre les papiers qui entraient par la porte ou les fenêtres du parlement. Nous savons par maint exemple, qu'il ne fallait pas espérer de voir le parlement lâcher sa proie. "Vous qui entrez ici, abandonnez toute espérance."

Talon écrivait à Colbert, après avoir passé quinze ou seize mois dans la colonie, que la noblesse n'y était composée que de quatre anciens nobles. Qu'entendait-il par ce chiffre de quatre? En réalité il y avait au moins quatorze familles d'ancienne noblesse.

Il continue "et quatre autres chefs de familles (canadiennes) que le roi a honoré de ses lettres l'année dernière."

L'année dernière, c'est 1665. Nous n'avons pas de trace de ces nominations.

Talon ajoute: "Outre ce nombre, il peut y avoir encore quelques nobles entre les officiers qui se sont établis dans le pays. Comme ce petit corps est trop peu considérable pour bien soutenir, ainsi qu'il est naturellement obligé, l'autorité du roi et ses intérêts en toutes choses, mon sentiment serait de l'augmenter de huit autres personnes le plus méritantes et les mieux intentionnées, en laissant les noms en blanc, ainsi qu'il a été fait l'an passé."

Une colonie naissante a besoin de plus d'une classe d'hommes à la fois éclairés, dirigeants et intéressés pour son compte au bien-être des habitants. A partir de 1663, Colbert, Louis XIV, Talon et autres adoptèrent cette vue. Sur les basses déjà solides de nos familles rurales, on plaça la noblesse de talent et de bonne volonté; on appela à ce rang supérieur dans le nouvel ordre de choses, non seulement des Français mais aussi des Canadiens de mérite reconnu, susceptibles de faire honneur à cette distinction. Dès lors, si quelqu'un a eu raison de se plaindre du résultat, ce n'est certes point l'habitant.

Enfin, Talon soumet les noms de Jean Godefroy, Charles Le Moine Simon Denys, Mathieu Amiot, Louis Couillard pour annoblissement. M. de Tracy, de son côté, propose Jean Bourdon, Jean Juchereau, Denis-Joseph Ruette d'Auteuil, Pierre Boucher.

Comment se fait-il que l'on recommande Denys, Couillard et Boucher qui étaient déjà anoblis? Peut-être que le défaut d'enregistrement rendait nulle la première nomination. Puis, il y avait en ce moment une recherche des faux nobles, dont je vais parler.

Notons que Jean Godefroy, Charles Lemoine, Simon Denys, Mathieu Amiot, Louis Couillard furent anoblis, au gré de Talon, toutefois ils ne furent enregistrés que plus tard, comme nous le verrons.

Les protégés de M. de Tracy ne recevaient rien.

IV

Ce que l'on appelait titre de noblesse n'était stable que dans certains cas. Il fallait vivre noblement pour le conserver. N'allons pas dire: "Une fois noble toujours noble", puisque cet état était plutôt précaire. Les tribunaux du royaume se voyaient constamment occupés à la vérification des anciens titres, afin de les rendre valables

et aussi à la poursuite des faux nobles ou de nobles non récemment enregistrés, car ce n'était pas tout que d'être nommé une première fois. Ce n'était pas tout que d'avoir été enregistré en Normandie à diverses reprises; si vous vouliez vous faire valoir dans la Touraine, on exigeait la production de vos titres.

Que penser alors des titres de Couillard, Giffard, Boucher, du pays du bout du monde, sans enregistrement ? Talon a bien fait de recommencer les sollicitations en faveur de Couillard et Boucher. S'il n'a pas mentionné Giffard c'est que celui-ci était enregistré et de plus se mourait, laissant un fils de vingt-trois ans qui vécut noblement.

En dépit de plusieurs arrêts royaux, de faux nobles figuraient partout en France et "s'évertuaient à s'affranchir du payement de la taille". Au mois de mars 1666, le conseil du roi prescrivait la recherche des titres douteux et ordonna que tout anoblissement postérieur à 1643 (avènement de Louis XIV) serait nul, quitte au souverain régnant à renouveler ceux qu'il jugerait à propos. Les lettres-patentes, rafraîchies de cette manière, s'obtenaient à prix d'argent. La taxe n'était que déguisée.

Voilà pour la France. Quant au Canada, on se contentait de faire payer les frais de chancellerie et c'était déjà trop.

La taxe en France était onéreuse. Quiconque se disait noble espérait y échapper. Au Canada, le roi ne taxait que les peaux de bêtes sauvages, de sorte que le titre de noblesse ne favorisait point la propriété.

En 1666, Louis XIV vendit pour deux millions de francs à un spéculateur le droit d'amener devant les tribunaux toute personne portant le titre d'écuyer, et de faire condamner à l'amende les usurpateurs de ce titre. La panique fut grande dans les classes moyennes et même plus élevées. Le fermier de cette étrange poursuite gagna beaucoup d'argent dans la râfle qu'il sut exécuter et, chose amusante La Fontaine le fabuliste, Racine le poète tragique y furent pincés. Boileau le satirique prouva quelques vieux droits dont s'arrogeait sa famille et passa doucement, mais renonça au titre, trouvant que le jeu n'en valait pas la chandelle.

Plus tard, en 1695, à l'occasion de nouvelles poursuites contre les faux nobles, Boileau prouva qu'il était gentilhomme de vieille date par la famile de son père—et voilà comment il écrivit à son ami Dangeau:

La noblesse, mon bon, n'est point une chimère!

Louis XIV, en besoin de fonds pour monter sa marine, taxait la vanité humaine, ainsi qu'il l'exprima plaisamment. Un riche commerçant très considéré à la cour, ayant demandé et obtenu des

lettres de noblesse, se vit regardé avec indifférence par le roi et s'en plaignit, mais le monarque lui indiqua sa place en peu de mots: "Vous étiez le premier marchand du royaume; vous en êtes aujourd'hui le dernier gentilhomme".

Il est probable que le Canada n'entrait point pour une forte somme dans ce calcul royal, mais la règle du renouvellement était générale. En France, elle rapporta un bon revenu, dont une certaine partie était pour le dénonciateur dans le cas des faux nobles. Le pouvoir, mis en appétit, alla plus loin. Nombre de gens accolaient à leur nom le titre d'écuyer sans droit reconnu. Il se présenta un financier qui, moyennant une contribution au trésor, acquit le privilège de poursuivre en justice et faire condamner à l'amende s'il y avait lieu les porteurs frauduleux de ce qualificatif, jadis très distingué, bien que devenu de nos jours un peu banal—mais il était encore, en 1670 réservé à la noblesse authentique.

Selon l'ancienne pratique, le roi, en 1669, abolit les titres de noblesse non enregistrés et appela les prétendus nobles à faire valoir leurs droits.

V

Revenons au Canada. En 1671 on y reçut une lettre du roi disant qu'il était très désirable de voir des membres de la noblesse prendre le chemin de la colonie. Il oubliait de dire comment on pourrait les faire vivre.

Cette même année, Talon devint baron des Islets, quoique la terre ainsi titré n'ait ni des îles ni des îlets dans ses limites. Talon y avait fondé trois villages à la mode de France: Bourg Royal, Bourg la Reine et Bourg Talon—Charlesbourg aujourd'hui. Ce domaine devenant baronnie transmettait la noblesse au propriétaire, mais Talon était noble d'autre source puisque, dans sa lettre de 1668 à Jean Godefroy, il offre de lui donner l'une des figures de son écusson: une épée posée en pal—ce qui est la marque des croisades. Godefroy mit l'épée dans ses armes.

Après Coulonge vient comme date et terre noble la baronnie des Islets.

Le grand fief de la Citière, qui s'étendait depuis la rivière Châteauguay jusque, et y compris, Saint-François-du-Lac, accordé vers 1635 à Jean de Lauzon, n'a été qu'une concession ordinaire, sans titre noble ni privilège.

Le départ de Talon du Canada (1672) ne lui fit pas abandonner ses projets de ce côté. Il assista le roi et ses ministres de ses conseils. En 1676, sa baronnie se transforma, quant au nom, en comté d'Orsainville, puis, en 1682, ce titre fut transporté à sa seigneurie du Hainault que sa famille conserva après lui.

A Québec, le 5 décembre 1672, Joybert de Soulanges, de la Cha pagne, enregistre sa généalogie noble qui commence en 1350.

Frontenac, à peine arrivée de France, écrit à Colbert que les lettres de Jean Godefroy relatives à sa noblesse sont restées inactives au parlement de Paris. Ces pièces sont reçues à Québec l'année suivantes, mais le Conseil déclare qu'il ne peut les enregistrer parce que leur adresse est le parlement de Paris. Sur de nouvelles instances de Frontenac, Colbert demande les lettres. L'intendant Duchesneau les lui envoye en 1677. Elles vont dormir dans le bureau des Colonies.

En 1673, Frontenac forma une assemblée de la noblesse, du clergé et du tiers-état ou bourgeoisie, selon les anciennes coutumes françaises, pour délibérer sur certaines affaires publiques, mais Louis XIV désapprouva la démarche sur le principe qu'il ne fallait pas consulter tant de gens à la fois. Le régime absolu du roi-soleil n'acceptait rien de ce qui avait la couleur d'une liberté politique. Selon lui, lee gouvernement venait d'en haut—de sa personne royale—et non pas de l'inspiration d'une classe d'hommes, et encore moins de l'opinion formée par plusieurs classes. Cette tentative de convention national montre que Frontenac estimait la valeur de la noblesse, même dans une colonie.

La famille Couillard, aidée de Frontenac, demandait ses lettres de noblesse, enterrées mais non entérinées au parlement de Paris. Le roi répondit, le 24 avril 1675, par un ordre d'avoir à les enregistrer, insinuer, entériner, selon les termes de la loi, mais le Conseil de Québec n'en fit rien, je ne sais pourquoi. Nous verrons plus tard la suite.

Même chose à l'égard des titres de Charles Lemoine. L'ordre des du roi est aussi de 1675. Rien de fait.

Le 30 septembre 1675, le Conseil de Québec, ou Conseil Souverain, prend note des lettres de noblesse accordée en 1628 par le duc de Savoie à Claude Villieu, puis enregistrée au Poitou, en 1662, par le fils Sébastien Villieu, puis l'acte du mois de juin 1668 de Louis XIV qui naturalise le dit Sébastien et, finalement, enregistre le tout. Villieu était arrivé avec le régiment de Cariguan en 1665.

François Berthelot qui était conseiller en France, secrétaire de la dauphine, secrétaire-général de l'artillerie, poudres et salpêtre du royaume, brasseur d'affaires, seigneur de l'île Jésus près de Montréal, échangea celle-ci contre l'île d'Orléans qui appartenait à Mgr de Laval, et, en 1676, le roi érigea l'île d'Orléans en fief noble, sous le nom de comté de Saint-Laurent, de sorte que le roturier Berthelot devint le comte de Saint-Laurent. En 1704 Berthelot vendit l'île à la famille Duchesnay—et de là est venue la comtesse de Saint-Laurent, mais notons que l'île était retournée à Berthelot dès 1705, et qu'il la vendit

à Guillaume Gaillard en 1712 lequel la garda et la transmit à sa descendance.

Robert-René Cavelier de la Salle, que Frontenac protégeait, acheta du roi, en 1675, le fort de traite Cataracoui et reçut en même temps des lettres de noblesse, probablement en vue de ses découvertes futures—découvertes que le même roi désapprouva fortement dès qu'il en eut connaissance. Cette histoire est curieuse. Frontenac, en 1673, avait construit le fort contre le gré du roi, qui l'obligea à s'en défaire. La Salle emprunta la somme exigée (10,000 francs) de Charles Bazire, marchand de Québec, et paya comptant, de sorte que le gouverneur se voyant sorti d'une impasse, envoya l'argent au roi en recommandant La Salle pour une distinction. Lorsque, en 1682, survint la banqueroute, Bazire entra en possession de la traite de Cataracoui pour se refaire. Pendant ce temps, La Salle courait vers le Mississipi au grand déplaisir de Louis XIV.

Le 24 avril 1678 le roi écrivait au conseil Souverain de Québec lui enjoignant d'enregistrer les lettres en faveur de Jean Godefroy, Simon Denys, Charles Couillard et Charles Le Moyne, lesquelles n'avaient point été reconnues par ce conseil vu qu'elles étaient adressées au parlement de Paris. Il y a apparence que le Conseil se contenta de lire la dépêche royale.

En juillet 1681 les documents de Godefroy n'étant pas revenus du bureau de Colbert, l'intendant Duchesneau promulgua une défense d'inquiéter Godefroy au sujet de sa noblesse. Au mois de juin 1685, l'intendant de Meulles publia une défense semblable et quelques semaines après il fit enregistrer les lettres (copie probablement) aux Trois-Rivières, le Conseil Souverain refusant d'agir, de sorte que l'affaire n'était pas terminée.

L'ordre du roi du 24 avril 1678 est copié au registre du Conseil Souverain le 3 mai 1681, mais, nonobstant la phrase du prince qui porte: "le Conseil Souverain de Québec refusant de les enregistrer parcequ'elles sont adressées au parlement de Paris.... ordonne de les enregistrer," tout resta dans le *statu quo*. Manifestement les conseillers n'avaient pas autant que le monarque la passion de créer une noblesse canadienne; or, ces conseillers se montraient si clairvoyants sur tout ce qui concernait la colonie et si actifs à prendre ses intérêts que leur manière de voir à propos de la noblesse me semble digne d'attention. Ces hommes identifiés aux choses du pays se nommaient Louis Rouer de Villeray, Mathieu Damours des Chauffours, Nicolas Dupont de Neuville, Charles Denys de Vitré, Claude de Bermen de la Martinière, François-Madeleine Ruette d'Auteuil, Charles Le Gardeur de Tilly, J.-B. de Peiras, une réunion de marchands

légistes, nobles, cultivateurs représentant toutes les classes existantes de la société.

Jacques le Neuf de la Poterie avait fait reconnaître par le Conseil Souverain (1675) son droit de se qualifier d'écuyer, ce qui donne à croire qu'on le lui avait contesté. Nous voyons, mais rarement, dans ces époques, des conflits entre familles se disant nobles ou plus nobles que les autres.

Ce qui advint à Rouer de Villeray à propos de sa qualité d'écuyer n'était pas une querelle ordinaire, mais purement politique, et Frontenac qui la suscita s'en mordit les pouces. Toute l'année 1681 retentit de ce débat, comme de celui de Portneuf dont voici l'histoire:—

Pierre Robineau, trésorier général de la cavalerie légère du royaume et l'un des Cent-Associés ne vint jamais au Canada, mais, en 1645, il y envoya son fils cadet René, âgé d'a peu près vingt ans, et gardant en France l'aîné, François Robineau, écuyer, sieur de Fortelle. Le jeune René se livra au commerce des fourrures et fit, par occasion, la chasse aux Iroquois. Vers 1650 il commandait le camp volant que d'Ailleboust des Musseaux avait formé. C'était un garçon actif. Par suite de son mariage (1652) avec Anne fille de Jacques Le Neuf de la Poterie, il devint propriétaire de la seigneurie de Portneuf où il avait "un manoir décoré de toutes les marques de noblesse et seigneurie, accompagné d'une belle chapelle où se célèbre le service divin, tant pour le dit seigneur et sa famille que pour les domestiques et habitants de la seigneurie; il y a plusieurs bâtiments pour loger les domestiques, chevaux et équipages, étables, granges, parcs, jardins, bois, moulins." A part cela, les îles Bouchard, au dessous de Montréal. Son frère François Robineau sieur de Fortelle, "chevalier de l'ordre de Saint-Michel, conseiller du roi et maître d'hôtel ordinaire du roi, ayant contribué pareillement au dit établissement", René lui a "concédé plusieurs grands avantages qu'il avait en France pour faire son habitation ordinaire au pays de la Nouvelle-France en ses dites terres et seigneuries, où il demeure depuis trente-six ans et y vit très honorablement, étant pourvu de la dignité de grand-voyer du dit pays, où il est marié, ayant une famille de neuf enfants (dont six garçons) le second desquels, après avoir passé en France et servi le roi dans les armées l'espace de dix ans consécutives en qualité de volontaire et, depuis, en celle de capitaine de dragons, repassa au dit pays de la Nouvelle-France."

Au mois de mars 1681 le roi érigea Portneuf en baronnie, mais le 4 novembre suivant, les lettres patentes étant placées devant le Conseil Souverain de Québec, avec demande de les enregistrer, une forte cabale s'y opposa, sous l'inspiration de l'intendant Duchesneau. Alors Frontenac prit cause pour Robineau et il y eut un tapage général

au conseil et dans la ville. Le gouverneur fit venir Le Gardeur de Repentigny avec trois des fils de Robineau pour intimider l'intendant et ceux qui le supportaient. Il n'y eut pas moyen de conclure.

D'autres chicanes, plus importantes, agitaient le conseil: le tout fini par le rappel de Frontenac et Duchesneau. L'enregistrement des lettres en question eut lieu le 28 avril 1683.

Les fils de Robineau ont été des hommes remarquables au Canada et en Acadie. L'aîné s'établit à Bécancour, dont il était seigneur, colonisa et vécut très vieux. C'est lui que Charlevoix appelle baron de Bécancour—il était baron de Portneuf et seigneur de Bécancour.

VI

L'intendant Duchesneau éleva le premier la voix contre la noblesse du Canada. Dans sa lettre à Colbert, du 10 novembre 1679 il affirme que la plupart des gentilshommes sont dans la pauvreté et cela par leur faute vu, dit-il, qu'ils négligent leurs terres, passent leur temps à la chasse, vivent d'expédients et, pour subsister, contreviennent aux ordonnances sur la traite. Eux et leurs fils courent les bois, ajoute-t-il, invitent les jeunes habitants à les suivre, se plongent dans les dettes et, malgré tout, ils veulent tenir un rang élevé.

Au premier abord, si l'on en juge par les lettres de M. de Meulles, le nombre des nobles semble prodigieux dans une colonie de douze mille âmes car, dit-il, "tout le monde, à peu près, se qualifie de gentilhomme et prend le titre d'écuyer", mais en examinant les choses de cette époque, je comprends que cette innocente manie des titres n'était pas la cause du mal dont souffrait la noblesse et qu'une bien petite partie de la vraie noblesse se targuait de ses origines. Les titres usurpés étaient pris sans gêne par des familles qui se faisaient valoir en conséquence de leur richesse.

M. de Meulles dénonçait avec persistance les gentilshommes du Canada engagés dans la traite des fourrures sans la permission des marchands qui en avaient le monopole. A cela, le caustique la Hontan répond: "Je crois que M. de Meulles n'a pas négligé ses propres affaires. Il y a même apparence qu'il a fait un certain commerce souterrain qui est un vrai petit Pérou".

Cet intendant était choqué de voir les simples lieutenants-gouverneurs de Montréal et Trois-Rivières prendre le pas sur lui aux assemblées et réunions officielles. Il regardait d'un œil dédaigneux les "illustrations coloniales". L'automne de 1685, il écrivait à la cour demandant qu'on ne permît plus à des gens aussi pauvres que les nobles du Canada de figurer en tête des autres représentants de

Sa Majesté. En ce moment, dans les salons de Versailles, se traînaient les familles décavées de tout le royaume.

Soyons sur nos gardes lorsqu'il s'agit de M. de Meulles. Il poussait la haine contre ceux qui lui déplaisaient jusqu'à écrire des choses qu'il savait être fausses. Ainsi, dans une dépêche de l'année 1685, il dit que Gaspard Boucher avait été cuisinier des Jésuites, et cela est mis avec l'intention de ravaler le fils, Pierre Boucher, qui ne s'en laissait pas imposer par l'intendant. Ce n'est pas M. de Meulles qui, de simples cultivateur comme les Boucher, aurait fait œuvre de fondateur de colonie et se serait vu conférer la noblesse par trois fois pour des services publics généreusement rendus.

De Meulles dit encore que la ville des Trois-Rivières ne renferme que sept ou huit misérables maisons, parce que le lieutenant gouverneur, gendre de Pierre Boucher, ne lui accorde pas la préséance. La ville comptait trente-six bonnes maisons, au dire de l'ingénieur du roi qui écrivait la même année et soumettait le plan détaillé de chaque partie de la ville.

Nicolas Denys étant passé en France pour faire renouveler ses titres sur une partie du golfe Saint-Laurent, y eut gain de cause. Pendant ce temps-là, de Meulles écrivait que Denys, tout noble qu'il était, demandait son pain dans les rues de la capitale du royaume– pour empêcher que l'on nommât de nouveau le fils, Denys de Fronsac, gouverneur de Gaspé.

Le 10 mars 1685, un édit du roi autorisa "tous les nobles et gentilshommes de faire le commerce, tant par mer que par terre, sans qu'ils puissent être recherchés ni réputés avoir dérogé". L'édit s'appliquait à la France et à tous les pays français.

Durant l'été de 1685, M. de Meulles, reçut instruction de rechercher les faux nobles et de les faire connaître. Les démarches qui s'en suivirent donnèrent occasion aux véritables nobles de s'affirmer, mais en même temps la situation de fortune de ceux-ci fut mise au jour—elle n'était pas brillante.

Pour se relever ces pauvres gens avaient la permission d'acheter et de vendre des marchandises. Le roi semblait dire: "Vous n'avez ni sou ni mailles, eh bien! mettez-vous dans les affaires". C'est l'histoire du vieux brave couvert de blessure et réduit à la besace qui implore l'aide du gouvernement—on lui envoye la croix d'honneur.

Or, le commerce du Canada était un monopole entre les mains de deux ou trois maisons qui payaient leur privilège au roi et recrutaient des employés un peu partout. Des Canadiens entraient dans le commerce—par la porte de service. La noblesse pouvait donc en faire autant, pas plus, et devenir coureur de bois aux gages des gros bonnets.

D'ailleurs, nous savons que, de tout temps, la noblesse a témoigné de l'aversion pour le négoce sous n'importe quelle forme. On ne fait pas des marchands au moyen de décrets. Lorsqu'une classe de la société est, depuis des générations, vouée à un genre de service unique—la noblesse n'était que militaire—elle n'est presque jamais transformable, à moins qu'il ne survienne des circonstances tellement extraordinaires que tout l'édifice soit renversé.

Pour sortir de la pauvreté, disait le roi, prenez la place des millionnaires. Polichinelle donnant un tambour et une trompette à ses enfants leur recommandait de bien s'amuser "mais ne faites pas de bruit".

Avant 1660, les nobles qui étaient venus d'eux-mêmes ne se plaignaient pas de leur sort.

VII

A partir de 1660 commença, lentement d'abord, l'immigration des gentilshommes, Colbert, Louis XIV et d'autres personnages induisaient des fils de familles nobles à faire souche dans la colonie pour y perpétuer le sentiment français, en un mot édifier une nouvelle France. Le projet était raisonnable, mais très peu de ces nouveaux venus possédaient des ressources pour coloniser. La plupart n'avaient aucun des talents requis en Canada. Pour toute fortune, ils nous ont apporté leur raffinement de politesse, le beau et bon langage du temps, force gaité, de la bravoure à pleine mesure—et c'est beaucoup que tout cela—de plus des défauts que nous n'avons pas acceptés et qui ont fait la ruine de cette classe d'hommes.

Nobles ou roturiers ils ont noblement fait leur devoir et formaient la classe supérieure de la colonie, comme Chavigny, d'Eschambault, La Tesserie et d'autres de ces premiers temps. Les descendants de chacun d'eux se sont mêlés au reste de notre population.

En 1685 les Le Gardeur, Boucher, Le Neuf, Le Moyne, Robineau, Aubert, Villerai, Lotbinière, Sorel, Godefroy et autres nobles, anciennement établis ou presque tous nés dans la colonie, étaient loin d'être pauvres. Auprès d'eux, les officiers venus depuis peu, qui avaient des seigneuries en forêt, n'étant ni assez riches ni assez bons défricheurs pour opérer des miracles, manquaient de tout, se plaignaient, mais vingt personnes qui se lamentent ne parlent point au nom de de douze ou quinze milles âmes.

En 1685, le gouverneur-général se croyait obligé en conscience de permettre à Gautier de Varennes une traite pour son compte dans un endroit défendu, à cause du bas chiffre des émoluments ($200) réguliers de ce fonctionnaire qui serait mort de faim ou réduit à la mendicité, avec sa nombreuse famille, sans la tolérance du pouvoir.

Vers 1717, comme on s'était aperçu que M. de Vaudreuil, gouverneur-général, se procurait certains bénéfices pour une traite illicite, le ministre répondit tranquillement: "Le malheur, c'est que M. de Vaudreuil est pauvre".

La même année 1685, M. de Denonville, gouverneur-général, faisait rapport au roi que les gentilshommes de la colonie étaient dénués de tout, mais très fiers de leurs titres et tâchant de paraître avec le plus d'avantage possible, sans parvenir à cacher la misère qui les dévore. A leur place, dit-il, j'aimerais mieux des habitants, car ceux-ci travaillent et sont prospères, tandis que le noblesse flâne et crève de faim.

La liste des récriminations du gouverneur sur ce sujet est longue. Il y revient dans trois ou quatre dépêches et ne ménage pas plus ses expressions que ne le fait M. de Meulles. Je sais, ajoute-il, qu'il y a des gentilshommes qui luttent avec honneur contre la mauvaise fortune, mais là où un habitant vivrait à l'aise, le personnage noble, soumis à plus de dépense, de perte de temps pour le service public et obligé de se vêtir mieux que son entourage, ne peut suffire aux exigences de la situation.

M. de Saint-Ours, officier licencié du régiment de Cariguan, devenu seigneur de la terre de Saint-Ours, était allé voir M. de Denonville pour obtenir la permission de passer en France, où il espérait trouver le moyen de gagner sa vie. Sa femme et ses enfants étaient réduits au désespoir par le manque du nécessaire. "Je les confierais, s'écriait-il en présence du gouverneur, à quiconque pourrait leur donner du pain". Parlant de cette famille, le même gouverneur fait son éloge et dit que tous les membres sont actifs: J'ai trouvé deux des filles occupées à couper le blé et M. de Saint-Ours tenait les mancherons de la charrue, mais ils ne sont pas les seuls dans cette condition déplorable. Ils viennent à moi tout en larmes. C'est l'heure de pourvoir à leurs plus pressants besoins, autrement, ils seront tentés de passer aux Anglais. Nos officiers mariés sont de vrais mendiants. Les conseillers du Conseil Souverain de Québec ne sont pas davantage favorisés du sort; on arrête leurs fils qui se font coureurs de bois. Enfin, il faut du secours".

Dans sa lettre du 10 novembre 1686 à Seignelay, fils de Colbert, le gouverneur Denonville disait: "Je dois rendre compte de l'extrême pauvreté de plusieurs nombreuses familles qui sont à la mendicité, toutes nobles ou vivant comme telles. La famille de Saint-Ours est à la tête. Il est bon gentilhomme du Dauphiné (parent du maréchal d'Estrades) chargé d'une femme et de dix enfants. Le père et la mère me paraissent dans un véritable désespoir de leur pauvreté. Cependant les enfants ne s'épargnent pas, car j'ai vu deux grandes

filles couper des blés et tenir la charrue". Il en nomme d'autres qui sont dans le même cas. La femme et la fille de Le Gardeur de Tilly labouraient la terre. Il craignaient que les fils de ces familles ne se livrassent aux Anglais, car dit-ils, ces derniers "n'épargnent rien pour pour attirer nos coureurs de bois et du côté du nord (baie d'Hudson) et du côté de la Nouvelle-Angleterre". Dans la même dépêche, il conseille d'accorder des lettres de noblesse aux riches seulement, "car de faire en ce pays un noble pour n'être bon ni au commerce ni à aucune autre chose, c'est augmenter le nombre des fainéants".

Personne ne venait de France au Canada sans la permission du roi. Lorsqu'il s'agissait du bas peuple le départ n'était pas entravé, mais le Conseil Souverain de Québec surveillait les arrivages, voyait à placer les cultivateurs ou ceux qui voulaient apprendre cet état, et il ne se gênait guère pour renvoyer en France les bouches inutiles, mais la noblesse.... Ceux-là venaient non seulement par permission du roi, mais souvent par des influences qu'il ne fallait pas mécontenter, et c'étaient des gens incapables de gagner leur vie qui se répandaient dans les trois villes, dans les campagnes, comme des âmes errantes, à la charge de personne et de tout le monde. Cet élément était impropre à la culture du sol, l'unique emploi des bras dans la colonie. Son introduction sur les bords du Saint-Laurent constituait une sorte de calamité.

Le roi crut avoir compris la situation. Il continuait à se tromper. Comme remède, il déclara qu'il n'accorderait plus de lettres de noblesse au Canada. On ignorait donc à Versailles que les Canadiens anoblis vivaient tous très bien, et que les nobles venus récemment de France étaient seuls à se plaindre. Peut-être le roi eut-il comme une lueur de cette vérité, car il envoya six commissions en blanc pour nommer autant d'officiers dans les trois ou quatre compagnies de troupes de la colonie—avec injonction de choisir des fils nobles tombés dans le dénuement—je pense que trois, au moins, de ces commissions allèrent à des Canadiens et non pas aux nécessiteux. Le roi envoya aussi quelqu'argent en aumônes, avec l'ordre de se mettre au travail et de ne plus trancher des gens de qualités.

C'était sec et peu juste. Le roi avait insisté pour que ces personnes vinssent dans le pays et il ne pouvait s'attendre, une fois là, à les voir abattre la forêt, enlever les souches, labourer la terre, sans le sou, sans expérience et en sus tenir rang de noblesse et rendre des services comme telle, gratuitement, comme si l'impossible était le plus aisé du monde.

Parkman, qui a tant pillé nos livres, aurait bien pu les mieux comprendre que de dire que ces demandes de secours font voir la détresse de la colonie. Ces sollicitations d'aide étaient faites au nom

d'une vingtaine de familles. L'habitant jouissait du plein fruit de son labeur et de celui de son père—il était le vrai seigneur du Canada.

Le baron de la Hontan, officier dans les troupes, écrivait, en 1684: —"Les paysans du Canada sont fort à leur aise. Je souhaiterais une aussi bonne cuisine à toute notre noblesse délabrée de France. Que dis-je! Paysan? Amende honorable à ces messieurs. Ce nom-là, pris dans la signification ordinaire, mettrait nos Canadiens aux champs (en furie). Un Espagnol, si on l'appelait villageois, ne froncerait pas plus le sourcil, ne rélèverait pas plus fièrement sa moustache! Ces gens-ci n'ont pas tort, après tout: ils ne payent ni sel, ne taille; ils chassent et pêchent librement, en un mot, ils sont riches. Voudriez-vous donc les mettre en parallèle avec nos gueux de paysans? Combien de nobles et de gentilshommes jetteraient à ce prix-là les vieux parchemins dans le feu!"

Les Habitants du Canada ont toujours repoussé avec horreur la qualification de paysans, parceque celle-ci entraîne l'idée de taxe de tailles, de corvées, d'impôts, de misères, d'humiliations, enfin des charges et un asservissement qui pesaient alors en France sur l'homme du sol, du pays (paysan)—ces restes de la féodalité ou l'être humain était attaché à la terre, à la glèbe, au servage de la même manière que les animaux.

Aux yeux de la Hontan notre cultivateur était noble.

VIII

Voyons quelques notes sans suite qui, néanmoins, peuvent être bonnes à consulter.

Dans la compagnie du capitaine Des Meloises qui arriva en 1685, il y avait un sergent du nom de Jean Sicard de Carufel, du haut Languedoc, dont la noblesse avait été reconnue en 1530 et en 1669, Il se maria à l'île d'Orléans, fut seigneur du fief Carufel, près Maskinongé, portait le grade d'enseigne dans les troupes en 1732 et laissa une descendance assez nombreuse aujourd'hui.

Des Meloises était noble, comme tous les officiers des cinq ou six compagnies arrivées depuis 1684, et comme ceux qui vinrent par la suite. La moitié de ces militaires se sont mariés dans la colonie. J'ai de quoi écrire au volume sur eux.

Sabrevois de Bleury, natif de Chartres était lieutenant d'une compagnie en Canada et parait être venu en 1687.

Philippe Rigaud de Vaudreuil arriva en 1687, capitaine d'une compagnie formée pour servir en Canada. La maison de Rigaud date sa noblesse de 879. Il avait servi longtemps dans le corps de gentilshommes appelés les mousquetaires du roi. Sous le nom de marquis de Vaudreuil il fut gouverneur de la Nouvelle-France.

Un capitaine du régiment de Cariguan, Antoine Pécaudy de Contrecœur, marié en Canada, s'occupant, comme seigneur d'agriculture et de colonisation, fit confirmer, à Québec, en 1687, ses titres de noblesse qui dataient de 1661. Il était du Dauphiné et avait suivi le régiment de Cariguan depuis sa création, comme aussi le régiment de Montesson, et avait de beaux états de service.

Nicolas Juchereau de Saint-Denys, né en Canada, s'était distingué à la défense de Québec en 1690. Frontenac le recommanda pour la noblesse et ses papiers furent enregistrés à Québec en 1692.

Le gouverneur avait également fait l'éloge de François Hertel de la Frenière né en Canada, le même qui dirigea l'expédition de 1689-1690 contre le New-Hampshire, et remporta des avantages signalés à la tête d'une troupe de miliciens, mais, en 1691, lorsque les lettres de noblesse arrivèrent, Hertel déclara qu'il n'avait pas les moyens d'acquitter les frais de chancellerie et l'affaire n'eut pas de suite pour le moment. En pareil cas, le souverain pouvait récompenser le mérite d'une autre manière, mais Louis XIV se bornait à la dépense du parchemin, et encore se la faisait-il rembourser à double et triple prix.

Sur de nouvelles instances, le ministre du roi écrivait à Frontenac en 1698: "Sa Majesté n'a pas voulu entrer dans la demande du sieur Hertel, et si cet homme n'est pas en état de payer le sceau des lettres de noblesse qu'elle lui a accordées, il le sera encore moins d'en soutenir la qualité. Sa Majesté ne les aurait pas accordées si, elle avait été informée de sa pauvreté, étant certaine que cela ne servirait qu'à jeter ses enfants dans le désordre, qui auraient pu s'adonner à des travaux qui ne conviennent point à des gentilshommes".

Cette dépêche prouve que le roi exigeait de la fortune chez les nobles du Canada, mais ne se mettait pas en peine de leur procurer les moyens d'y parvenir.

Après la mort de Louis XIV, qui survint en 1715, Hertel renouvela sa demande. Il faut croire que, il y a deux cents ans, comme aujourd'hui, la vanité humaine se tourmentait pour des titres vides. Vers 1720 il reçut son parchemin. On ne dit pas s'il le paya ou non. En 1722 il mourut, laissant des fils qui avaient déjà gagné tout ce que des lettres de noblesse sont sensées reconnaître.

L'anoblissement de Simon Denys de la Trinité, remontant à 1669 n'avait pas été reconnu au Conseil de Québec, peut être même jamais présenté à ce corps. Il y fut enregistré le 30 juin 1692.

Les fils de Guillaume Couillard et de Charles Le Moine dont les lettres de noblesse traînaient les greffes depuis si longtemps furent assez heureux pour obtenir enfin gain de cause: on les enregistra à Québec, le 30 juin 1692.

Le même jour furent enregistrées les parchemins de feu Jean Godefroy que nous avons laissés entre les mains de Colbert quinze années auparavant. Or, ce n'était pas la fin de l'affaire. On découvrit sans doute quelque défaut de forme, puisque, en 1713, René Godefroy de Tonnancour sollicita un renouvellement, mais Louis XIV (1715) mourut et ce fut à recommencer. En 1717 répétition de placet, si bien que, au mois de mars 1718 la pièce tant désirée arrivait....et en 1721 elle reçut l'enregistrement.

L'anoblissement de Charles Aubert de la Chesnaye est du mois de mars 1693, signé à Versailles, ensuite inscrit à la chambre des Comptes du royaume le 24 avril 1694, puis à la cour des Aides de Paris le 12 mars 1699, finalement à Québec le 11 janvier 1700.

Le Ber, marchand de Montréal reçut des lettres de noblesse datées du mois de novembre 1696, mais elles ne furent reconnues que le 9 mars 1717.

Pierre Boucher vivait encore lorsqu'eut lieu (1701) l'incendie du séminaire de Québec qui consuma ses lettres de noblesse non enregistrées. Il en demanda d'autres, qui arrivèrent en 1707 et qui sont restées. C'était la troisième édition.

Citons encore la famille d'Ailleboust qui reçut confirmation de sa noblesse en 1720 par le Conseil de Régence. La famille D'Amours qui fit enregistrer ses titres de noblesse en France, cinq années plus tard. Rastel de Rocheblave, arrivé au Canada vers 1755, datait sa noblesse de 1274. Il était fils d'un marquis, du Dauphiné. Sur un certificat de d'Hozier, qui tenait le registre de la noblesse française, il obtint d'être enregistré à Québec en 1787—dans une possession britannique—le cas est rare. Rocheblave était un homme d'influence dans le Bas-Canada.

IX

Sauf les faits relatifs à Godefroy, à Le Neuf et à Villeray, il ne paraît pas y avoir eu, en Canada, beaucoup de contestation sur le terme d'*écuyer* illégalement pris par quelqu'un ou appliqué à la classe réputée noble, mais en France le roi n'entendait pas badinage sur le sujet, aussi mettait-il dans les lettres de noblesse: "portera le titre d'écuyer", car, sans cette permission bien et duement accordée il ne faisait pas bon de s'en affubler. On pouvait être "recherché", c'est-à-dire amené devant les tribunaux, condamné à l'amende, subir le ridicule et donner lieu à des chansons satiriques.

Depuis le temps de Champlain et conformément à la coutume française, nous avons fait usage du terme, l'appliquant aux gouverneurs, aux nobles, mais ni aux médecins ni aux notaires. Avant 1763 il n'y eut aucun avocat dans la colonie, donc cette classe est

hors de cause. Jusque vers 1800 le mot s'écrivait escuyer et escuier; on prononçait écuyer. La lettre s, dans l'ancienne langue, était placée après la voyelle pour indiquer l'accent à mettre sur cette voyelle: mesme, même, fenestre, fenêtre, etc.

En 1625, "Samuel Champlain, escuier, capitaine pour le roi.." fait un acte par devant notaire à Paris. Nous ne connaissons rien qui atteste la noblesse de Champlain, mais puisqu'il prend le titre d'écuyer c'est, sans doute, avec permission. Il n'était pas homme à se donner des apparences empruntées.

Son successeur par intérim se qualifiait: "Marc Antoine de Bras-defer, escuyer, sieur de Chasteaufort". Celui-là aussi devait avoir droit au titre. Cependant, on était sous Louis XIII et je crois que cette licence était assez fréquente alors. Les rigueurs à cet égard paraissaient avoir commencées lorsque Mazarin disparut et que Louis XIV prit les rênes de l'Etat.

En 1666 "fut présent Estienne Pezard, escuyer, sieur de La Touche, capitaine d'une compagnie de la garnison". C'est dans un acte du notaire Severin Ameau, qui n'écrivait rien sans examen préalable.

Dans le gouvernement des Trois-Rivières, sur moins de deux milles âmes, au XVIIème siècle, on trouve "écuyer" dans les familles Godefroy, Hertel, Gautier, Pezard, Chorel, Vauvril, Boucher, Robineau, Le Neuf, Ramesay, comme titre d'honneur et avec droit reconnu de le porter.

En 1681, lorsque Frontenac dénonça au Conseil Souverain de Québec la qualité d'écuyer que Rouer de Villeray prenait dans une pièce officielle, Villerai répondit que ses lettres de noblesse n'étaient pas enregistrées—comme bien d'autres—mais que le roi déciderait de l'affaire. Il ajouta que, dans cette colonie, la coutume n'était point de prouver le titre d'écuyer—mais ceci ne pouvait être qu'un relâchement de la loi du royaume.

Le 10 avril 1684, le ministre écrivait de Versailles à l'intendant de Meulles de ne pas laisser prendre le titre d'écuyer dans les actes publics à ceux qui ne sont pas gentilshommes—à peine de cinq cents francs d'amende.

J'ai vu quelque part que les simples nobles—à plus forte raison comtes, marquis et barons—prenaient la qualification d'écuyer de la création de leur noblesse, tandis que le noble de race naissait écuyer—et ceci est d'accord avec les brevets signés de Louis XIV.

D'où vient le mot en question? C'est matière à débat parmi les savants. Je choisis l'opinion d'un Canadien, Monsieur J. W. Miller qui, dans les *Recherches Historiques* de 1897 (p. 171) s'exprime comme on va voir:

"Si nous remontons au temps des Gaules, nous voyons que l'écuyer était armé de l'écu et du javelot. Sa dénomination de *scutifer* (langue romaine *escudier;* ancien français *escuyer*) fut évidemment tirée par les Romains du mot *scutum*, écu, et non d'*equus*, cheval, ainsi que l'ont avancé quelques étymologistes". Continuant, il observe fort justement que "*écuyer* et *esquire* ont une commune origine, mais n'ont plus la même synonymie. En France, il se donne aux professeurs d'équitation, aux acteurs et actrices à cheval, aux cavaliers qui donnent la main aux dames pour les mener". Il dit de plus:

"En Angleterre, *esquire* (on abrège, ordinairement: *Esq.*) est également tiré du latin *scutifer.* Ce titre fut porté à l'origine par ceux qui, sans être pairs, baronnets ou chevaliers, comme les fils aînés des chevaliers et leurs descendants, de même que les premiers-nés des fils des cadets de pairs et leurs descendants, avaient droit d'armoieries. Il s'y rattachaient une grande considération, parce qu'il s'appliquait à une notable portion de la noblesse anglaise; et plus tard on en vint à la donner à tout noble étranger. Aujourd'hui, toutes les fonctions publiques, depuis celle de juge de la paix, et les titres de docteur dans une faculté et d'avocat, donnent droit à la qualification honorifique d'*esquire.* Mais il est d'usage de l'ajouter également, par politesse, sur l'adresse des lettres, au nom des négociants, et en général à celui de tout homme qui a reçu une certaine éducation ou qui est parvenu à se créer une certaine position sociale".

Au Canada, c'est comme en Angleterre depuis plus d'un siècle.

Ne serait-il pas juste de dire que le mot *escuier* a passé la Manche avec Guillaume-le-Conquérant et qu'il se trouve avoir été emprunté à la France ou si l'on veut la Normandie, mais qu'il venait du latin ?

Un arrêt du conseil du roi, du 15 mai 1703 (article III) dit que la qualification de "noble homme" insérée dans un acte de notaire pourra être contestée, comme ceux d'écuyer et de chevalier. Déclare aussi Sa Majesté que "noble homme" est une qualification noble dans la province de Normandie.

La question était donc devenue douteuse puisqu'il fallait l'intervention du souverain pour la trancher ? Oui puisque à l'occasion de la grande réforme de 1666-1669 dont j'ai parlé, le terme "noble homme" avait été réjeté dans la roture.

Dans la roture également fleurissait "honorable homme" qui se rencontre parfois sous la plume du notaire et du curé canadien. Il s'agit d'habitants notables, considérés, des gros bonnets. De même "honnête femme Marguerite". . . . doit se prendre dans le sens du temps: respectable et d'un monde poli. On disait également des personnes qui avaient le vernis et l'usage de la bonne société: ce sont d'honnêtes

gens. Le censitaire présentait au seigneur "un bouquet honnête et licite" c'est à dire convenable, raisonnable de volume et de forme, digne d'être accepté comme hommage.

Le tabellion, le missionnaire, l'officier civil, dans leurs écritures, se faisant l'écho de l'entourage, gratifiaient d'expressions flatteuses ceux qui figuraient au dessus du commun dans la paroisse.

Dans la classe qui tenait le milieu entre la noblesse, la robe (justice et clergé) l'épée, le peuple— disons la bourgeoisie—nous avions le *sieur*, diminutif de *monsieur*, comme celui-ci est la contraction de *monseigneur*. C'étaient là, et ce sont encore des formules de politesse. Le fils d'un pauvre hère pouvait devenir sieur ou monsieur tout comme aujourd'hui.

Ecuyer ne se donnait que sur droit. Honorable homme passait plus facilement. Monsieur est rare mais ne se faisait pas trop prier. Le sieur est partout, mais ne faut pas le confondre avec ceci, par example: Joseph Giffard sieur de Fargy, car, en ce cas, on mentionne une terre dont il était seigneur. Drôle d'idée de retourner Giffard en Fargy!

Le "de" veut dire un tel *de* tel endroit ou lieu. Il n'implique pas la noblesse. En parlant de Robert Giffard, on disait "Monsieur de Beauport" longtemps avant qu'il eut été anobli. C'était la coutume de France. Monsieur de Grosbois se nommait ainsi avant que devenir noble. Tout ceci est tellement ordinaire dans l'histoire de France que personne ne s'en occupe. Nous avons en Canada des milliers de surnoms de la même source. A la longue, ces noms de terre remplacent les noms de famille sans lâcher le "de" surtout si l'euphonie s'y prête. Aucune autorité n'a rien à y voir. Le "de" ne tient pas à la noblesse, quoiqu'en dise le dictionnaire. Les titres nobiliaires ne le mentionnent jamais. C'était une affaire banale que chacun réglait à sa fantaisie.

On s'accorde à croire que Champlain ne fut jamais anobli, ce qui ne l'aurait pas empêché d'être le sieur de la Borde s'il eut possédé une terre de ce nom. Il aurait pu aussi écrire Laborde ou la Borde, vu que ces variantes n'ont jamais eu d'importance.

Le "de" frappe les imaginations, quoiqu'il ait une origine absolument roturière. La noblesse de France n'en faisait usage que dans les branches de famille, pour désigner une terre. Les bourgeois de même. Les Condé, par exemple, étaient Condé, ce qui n'empêchait pas que chacun d'eux s'appelait aussi du nom de son domaine, comme monsieur Boucher portait le nom de Niverville emprunté à son fief, mais cela ne le rendait pas noble; il avait fallu des lettres patentes du roi pour lui conférer la noblesse, et c'était monsieur Boucher

qui était devenu noble, non pas M. de Boucher, ou de Niverville ou de Grosbois.

De "dit" à "de" la distance n'est pas grande. Lemaître dit Lottinville (nom d'une terre) devient aisément Lemaître de Lottinville; Fafard dit Longval est communément M. de Longval, Volant dit Saint-Claude tourne en M. de Saint-Claude. C'est à n'en plus finir. Si tous ces noms étaient héraldiques, nous aurions eu autant de noblesse que la France, et par conséquent cent fois trop pour nos besoins.

X

Les localités de France d'où venaient nos colons contribuèrent souvent à leur imposer un nouveau nom—ainsi de Blois, de Bethune, de Bordeaux, de Dompierre, de Faye, de Foy, de Guise, de la Citière, de la Haye, de la Lalande et tant d'autres. N'a-t-on pas vu, au Canada, grand nombre de familles de cultivateurs prendre pour chacun de leurs garçons un nom de terre et presque toujours un nom qui retentit? C'était la coutume du temps et la question de noblesse n'entrait nullement dans l'esprit de ces braves cultivateurs.

A cause de la forme de certains nom, le lecteur est toujours tenté de croire qu'un grand nombre de gens mentionnés dans l'histoire du Canada appartenaient à la noblesse. Ceci est bien souvent trompeur. La langue française se prête facilement à cette manière de former le noms des personnes, peut-être plus qu'aucune autre langue. Ainsi de Lorme, de Vaux, de Blois. La particulier "de", qui n'a rien à faire avec la noblesse, est constamment prise pour un signe de grande famille. N'allons pas nous abuser sur ce point.

Mais puisque, en certaines rencontres il y a noblesse, je me demande où deux Canadiens, Boucher et Lemoine—sans compter les autres—ont pris les noms qu'ils ont imposés à leurs fiefs et qui sont devenus par là leurs noms de famille: Maricour, d'Iberville, Longueuil, Sérigny, Bienville, Châteauguay, Assigny, Grosbois, Montbrun, Niverville, Montizambert, Piedmont, La Broquerie, La Bruère, Laperrière, Grandpré. Ces noms devaient appartenir à des localités ou à des familles de France dont les Canadiens anoblis aimaient à garder le souvenir.

Longueuil était une seigneurie près de Dieppe, lieu de naissance de Lemoine. Sérigny était le surnom de d'Hozier juge d'armes de France. D'Iberville était premier ou second dans le bureau de la marine lorsque notre Pierre Lemoine se transforma en d'Iberville et prit du service en mer. La Bruère, Laperrière, Montizambert sont des endroits du Perche, d'ou venait Pierre Boucher.

Toute cette question est à étudier: *On le peut, je l'essaie: un plus savant le fasse.*

Voici 28 noms qui donnent 140 surnoms dans notre histoire:—

Amiot—Villeneuve, Vincelot, Neuville, Lespinière.

Aubert—la Chesnaye, Gaspé, Forillon, Millevaches.

Beaujeu—Villemonde.

Bequart—Grandville, Fondville.

Boucher—Grosbois, Niverville, Montizambert, Piedmont, Boucherville, Montbrun, La Broquerie, Laperrière, Grandpré, Labruère.

Chapt—Lacorne, Saint-Luc, Dubreuil, Colombière, la Chesnaye.

Couillard—des Prés, des Islets, Beaumont, Lespinay, Roquebrune, des Chênes, Du Puy, des Ecores.

Coulon—Villier, Jumonville.

D'Ailleboust—Coulonge, Musseaux, Manthet, Périgny, Cuisy, Argenteuil, Argentenay, Boulasserie, Madeleine, Saint-Vilmé, Cerny, Lynvilliers.

D'Amours—des Plaines, Chauffours, Fréneuse, Morandière, Clignancourt, Louvières, Courberon.

Denys—la Trinité, Vitré, Fronsac, la Ronde, Saint-Simon, Bonaventure, Thibaudière, Broqueterie.

Deschamps—Boishébert, Bouteillerie.

Drouet—Richerville, Coulonnier, Carqueville.

Duplessis—Faber, Montrampont.

Fleury—d'Eschambault, la Gorgendière.

Gautier—Varennes, Tremblé, Bourmois, la Verenderie.

Godefroy—Lintot, Normanville, Tonnancour, Vieuxpont, Roquetaillade, Saint-Paul.

Hertel—la Frenière, Rouville, Chambly, Montcourt, Beaulac, Cournoyer, Sorel, Sainte-Thérèse, Louisbourg, Beaubassin.

Jarret—Verchères, Beauregard.

Joybert—Marsan, Soulanges, d'Aulnay.

Le Gardeur—Repentigny, Tilly, Ponseau, Alançon, Lermite, Saint-Michel, Villiers, Montesson, Croisille, Saint-Pierre, Courtemanche, Beauvais, Caumont.

LeMoine—Longueuil, Iberville, Sérigny, Maricour, Sainte-Hélène, Châteauguay, Bienville, Marigny, Assigny.

LeNeuf—la Poterie, Hérisson, Boisneuf, Portneuf, Meneval, Neuvillette, Bécancour, la Vallière, Beaubassin, Villebon.

Levreau—Langis, Montigron, la Pilette.

Mouet—Moras, Langlade.

Ramesay—la Gesse, Monnoir.

Robineau—Villebon, Becancour.

Vaudreuil—Rigaud, Cavagnal.

XI

Depuis l'origine de la monarchie française jusqu'à la révolution de 1789, il y avait eu le peuple au bas de l'échelle, la noblesse au-dessus et le roi, en haut. Celui-ci était dépositaire de toute l'autorité; il ne déléguait des portions de son pouvoir qu'à des gens de noblesse. Le peuple servait à faire vivre tous les autres.

Sur ce modèle, on prétendit établir le Canada, mais les privilèges dont la noblesse jouissait dans l'ancienne France lui furent refusés dans la Nouvelle, sauf l'exemption de la taxe, et encore, entendons-nous, il n'existait aucune taxe directe dans la colonie—la douane et le monopole des fourrures formaient tout le revenu public.

La France renfermait, au dix-septième siècle, époque du peuplement du Canada, un grand nombre de familles nobles, que je diviserais en trois catégories distinctes: 1. celles qui possédaient des domaines, ou qui exerçait des charges importantes—la vraie noblesse; 2. celles qui n'ayant plus ni terres, ni revenus quelconques, ni talents ni fonctions, vivaient des miettes de la table royale; 3. celles qui étaient dénuées de tout, végétaient et composaient une classe en marge de la haute société, mais non pas mêlée à la masse du peuple. Ce sont les fils de ces dernières familles qui ont traversé l'Atlantique pour venir chez nous, à partir de 1684.

Ceux qui étaient venus avant cette date, tous de leur propre initiative, étaient arrivés à s'établir, ressemblant en cela aux humbles cultivateurs attirés ici par l'invitation des parents et amis et bien meilleurs colons que n'auraient été des gens racolés par le gouvernement ou les prétendues sociétés de colonisation.

Nous étions trop petits, trop peu riches, trop éloignés de l'Europe pour tenter les personnes de la première catégorie mentionnée ci-dessus.

Celles de la seconde catégorie n'avaient pas le courage de se soustraire à leur état de domesticité.

Les fils de famille sans avenir, mais qui avaient assez de cœur pour se remuer, venaient au Canada. Un bon nombre se fixaient dans le service militaire, d'autres se faisaient *habitants*[1]. Ces derniers appartiennent au peuple canadien, non plus à la noblesse, de même aussi que les enfants des hommes d'épée devenus défricheurs du sol soit par eux-mêmes ou leurs descendants.

Voyez-vous quelle sorte de noblesse nous avons eue? Aucun de ces transplantés n'apportait de France le moindre privilège.

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[1] Dans les Antilles françaises, ce mot a exactement le même sens que parmi nous.

Je le répète, notre situation était dépourvue de toute liberté politique, mais c'était chose voulue de par le roi et non pas à cause de la noblesse.

La position des fils de famille était, en certains cas, facilitée dans la colonie par des influences de parenté, cela se conçoit, mais, en somme, le tout se bornait à peu de chose puisque les emplois étaient minces et que, dans tout pays, le travail mérite salaire.

Il serait temps que l'on montrât la preuve que nous avons été gouvernés, opprimés, effacés comme colons par la noblesse. Quiconque affirme cela est tenu de le prouver. Nous ne pouvons que nier pareille assertion, après avoir vainement cherché sur quoi elle repose.

Ce que l'on peut reprocher à la conduite royale—sous Louis XIII, Louis XIV, Louis XV—c'est de nous avoir livrés aux marchands, aux exploiteurs du commerce; avoir mal entendu la valeur réelle de la colonie et de n'avoir guère prévu son avenir—mais non pas d'avoir laissé la noblesse ruinée venir y gagner sa vie par le travail.

La porte était ouverte à toutes les ambitions légitimes. Disons à l'honneur de ces jeunes gens que la plupart d'entre eux se montrèrent dignes des vieux noms qu'ils portaient. Ceux que leur instruction et un instinct particulier poussaient vers les rares professions ouvertes en ce pays ou vers le métier des armes—et c'étaient les plus nombreux—furent bien accueillis. Les autres prirent des terres, ce qui ne se refusait à personne. Les uns et les autres complétaient l'organisation de la Nouvelle-France et, pour tout dire, grâce à eux, nous nous sommes trouvés supérieurs en capacités aux colonies de maintes autres régions du globe, y compris la Nouvelle-Angleterre même, qui était pourtant plus forte que nous par l'argent et le chiffre de sa population.

L'absence de certaines classes de la société laisse une colonie dans une situation incomplète. Par endroit on voit de ces nouveaux établissements composés surtout de gens occupés aux mines, à la pêche ou au négoce; il y manque plusieurs agents ou éléments qui rendraient l'Etat plus complet et moins adonné à une seule occupation. L'édifice n'a qu'un rez-de-chaussée. En Canada il y avait quatre ou cinq étages.

Mentionnons pour ne rien oublier les quelques jeunes extravagants qui furent envoyés ici par certaines familles pour faire oublier leurs escapades en France, comme cela s'est vu de tout temps et se continue de nos jours. Il faut avoir de l'indulgence à l'égard de ces pauvres diables. Ce n'en étaient pas moins des garçons de belles manières, d'esprit alerte et de bonne langue qui ont contribué pour leur

part à introduire de la diversité parmi nous. Ici encore je signale la marque du gentilhomme.

XII

Il a été dit plus d'une fois que Louis XIV et Louis XV, voulant se débarrasser des chenapans dont la noblesse du royaume avait parfois à rougir, les expédiaient au Canada. Il y a un peu de vrai et beaucoup de faux dans cette affirmation.

Tout d'abord, constatons que la chose eut lieu après 1700, alors que la colonie était parfaitement fondée et ne pouvait subir l'influence de quelques étourdis sans sous ni mailles. En second lieu, le Conseil Supérieur de Québec ne fut pas lent à jeter les hauts cris, et cette sorte d'envois se trouva bientôt oubliée car on n'en fit plus aucun.

Les rejetons de noblesse mis en pénitence dans les forts de traite du fond des bois désertaient aux Anglais, ou s'amendaient et devenaient des gens acceptables; ou trouvaient grâce dans leurs familles et repassaient en France. Tous ensemble ne forment pas un total de trente individus. Ce n'est pas avec ce chiffre que la colonie s'est fondée, ni avec des gens de cette espèce.

En 1704, l'évêque de Poitiers sollicitait la permission de faire exiler deux gentilshommes qui causaient du scandale dans son diocèse. Le ministre du roi, M. de Pontchartrain, lui répondit: "Nous n'envoyons personne de force en Amérique."

Les titres de noblesse ne comportaient aucun privilège en Canada. C'était on peut dire comme le titre de "Sir" de notre temps. Aucune rente ni pension n'étaient attachése à ce rang. Chacun payait sa dignité de ses mérites et de sa personne, après, comme avant de l'avoir obtenue, et même il s'en suivait des obligations qui ne s'imposaient point au vulgaire, car noblesse oblige toujours a de certains devoirs ou de fréquents sacrifices de temps et de finance.

Le roi de France signait des lettres de noblesse en faveur des Canadiens qui s'imposaient à sa considération par leurs talents ou des services rendus—honneur vide sous le rapport de l'argent et des privilèges. La reine Victoria, son fils, son petit-fils agissent de la même manière.

Giffard, Boucher, Godefroy, Hertel, LeMoine du XVIIème siècle, c'est Lafontaine, Cartier, Dorion, Chapleau, Laurier de nos jours. Le trésor du roi n'en souffre point. Le peuple n'en est pas plus mal. Récompense au mérite, mais récompense simplement écrite—un acte de reconnaissance envers tel ou tel citoyen de marque et de bonne conduite.

Notre noblesse se composait de trois manières, mais c'était bien toujours la même classe quant à la vaillance militaire et aux apti-

tudes pour la guerre: 1. les Canadiens anoblis, tous cultivateurs et quelques-uns commerçants; 2. les cadets de vieille noblesse qui venaient ici dans l'espoir de se créer un avenir et qui n'entendaient pas trop la façon de s'y prendre; 3. les nobles arrivés avec des moyens et qui n'ont jamais tiré la langue ni crié misère.

La noblesse venue de France était, en plus grande partie, issue de l'armée. Elle brilla dans les guerres qui s'ouvrirent en 1684 et se continuèrent jusqu'à 1710, puis de 1744 à 1760.

Plus riche parcequ'elle était ancienne dans le pays et s'appuyait sur son travail, la noblesse canadienne emboîta le pas avec ardeur du moment où il fallut tirer l'épée. Son absence du foyer domestique ne dérangeait guère ses affaires, car les autres membres de la famille y pourvoyaient.

Il n'en était pas toujours de même des nobles français. Souvent le départ du père et des fils amenait la gêne dans la maison.

La solde des officiers militaires ne dépassait pas le tiers de ce que nous payons à présent pour les mêmes services. Les appointements des fonctionnaires civils étaient un peu plus élevés, mais les uns et les autres avaient recours à la chasse parfois à un commerce défendu, pour se soutenir tant bien que mal. Dans la sphère supérieure, on voit Talon, Frontenac, de Meulles, la Barre, Vaudreuil et d'autres chercher à se procurer des ressources par des moyens illicites. Sur les échelons inférieurs, la même pratique:—genre Louis XIV.

Il est vrai que l'agriculture n'a jamais été défendue à la noblesse; par exemple il ne faut pas confondre à cet égard la France avec le Canada. Les écrivains nous parlent des domaines qui rapportaient de gros revenus. Ce n'est pas tout dire. Un intendant de grand seigneur gérait le domaine, la seigneurie, mais le seigneur s'amusait à Versailles ou en ville et y dépensait son beau revenu.

Toute autre était la situation au Canada. Personne ici n'héritait d'un fief défriché, en pleine culture, avec hommes et bêtes établis. Le pauvre sire qui recevait un domaine en forêt et qui n'entendait rien au fait du défrichement, ni à la culture, qui n'avait pas de censitaire et dont la bourse était plate se compare-t-il au pompeux gentilhomme ci-dessus?

Durant la longue période de guerres qui commence en 1684 pour se terminer en 1760, la noblesse a rendu de signalés services au Canada. Elle était militaire avant tout. Les luttes contre les Iroquois et contre les Anglais attestent de la valeur de ce choix d'hommes. Il est vrai de dire que, si nous n'avions pas eu à supporter ces terribles épreuves, le rôle de la noblesse eut été bien mince parmi nous, mais enfin elle a eu son utilité dans les moments critiques, ne l'oublions pas. Allons-

nous demander aux généraux de la France des qualités de commerçants, de cultivateurs ou d'industriels ?

Au moment (1684) où s'ouvrait la longue série de guerres qui ont rendu le Canada célèbre, les colons étaient pour la plupart très bien établis, mais les seigneurs et en bonne partie des nobles n'avaient pas encore eu le temps de se débrouiller. Les maîgres ressources pécuniaires apportées de France s'étaient épuisées; les terres commençaient à peine à produire des redevances, etc., tandis que l'habitant avait le bon côté de la situation. Ce dernier seul pouvait amasser du bien . En un sens, il était comme seigneur. Il le devint davantage par la suite. Au moment de la conquête (1760) la plupart des seigneurs étaient des fils d'habitants.

Le seigneur du Canada était un simple agent de colonisation et s'il ne faisait pas de peuplement, son titre lui était enlevé, mais s'il parvenait à se procurer des colons il restait seigneur et jouissait des revenus attribués à cet état, selon le nombre d'arpents en culture. Nous voilà loin de la Seigneurie de France, comme tant de lecteurs se le figurent à cause de ce terme: *Seigneur.* La moitié des erreurs de l'humanité vient de ce que l'on ne connait pas le sens ou la portée des mots.

En 1684, la situation des habitants était à peu près celle de l'aisance par tout le pays, mais la noblesse n'avait guère progressé matériellement, et elle allait entrer dans une ère de combats à main armée qui ne lui laisserait pas le temps de surveiller ses propres affaires. Elle en sortit cependant pour voir la grande paix de 1715 à 1744, mais peu de ces familles en profitèrent.

XIII

Si j'ouvre certains livres écrits de nos jours, ceux de Parkman par exemples, je vois que l'on représente l'époque de 1680 à 1750 comme celle des prodigalités, des abus, de l'écrasement du peuple par la noblesse.

Sur le chapitre des dépenses, il faut blâmer tout le monde, en commençant par les simples cultivateurs qui, de tout temps se sont donnés le luxe des habits et de la table, chacun dans la mesure de ses moyens. Les personnes de plus haut rang vivaient dans cette note—mais la noblesse pauvre subissait la gêne sans pouvoir gaspiller.

Les abus n'existaient dans la colonie que par suite du système abusif de gouvernement imposé par le roi. Si le Conseil Supérieur de Québec eut eu le pouvoir en main, les revenus du Canada ne seraient pas allés à Versailles—et tout le reste à l'avenant.

La partie administrative qui était laissée aux Canadiens n'a jamais pesée sur le peuple. Mettez le doigt sur un point blâmable

de la politique de ce temps-là, la faute en est toujours imputable au roi, jamais à l'administration canadienne.

Si notre noblesse a un peu trop joui de sa position à cette époque on doit être capable de le démontrer. Il ne suffit pas d'une assertion dans ce sens, car la preuve du contraire existe.

Les écrivains croyent retrouver en Canada une vision de l'état de la noblesse de France sous Louis XIV et Louis XV. Ils ont trop étudié le royaume et pas assez la colonie. Le peuple français végétait dans la misère tandis que les hautes classes faisaient bombance. Sur les bords du Saint-Laurent la noblesse, sans privilège, sans fortune avait à peine du pain, tandis que les habitants faisaient la noce.

Ceux qui, à présent, prononçant avec mépris ou indifférence le nom de l'ancienne noblesse canadienne sont trompés par le terme même et par leur manque d'étude à ce sujet. Ils se figurent mal à propos les choses du moyen-âge et ne voyent qu'oppression et abus dans un milieu où la noblesse ne pouvait ni opprimer personne ni abuser de quoique ce fût. Les Habitants n'ont jamais eu à se plaindre de la noblesse; tandis que la noblesse avait toutes les raisons du monde de se plaindre de n'être pas du nombre des Habitants.

Charlevoix écrivait en 1720: "Tout le monde en Canada à le nécessaire pour vivre. On y paie peu au roi. L'habitant ne connait point la taille; il a du pain à bon marché; la viande et le poisson n'y sont pas chers, mais le vin, les étoffes et tout ce qu'il faut faire venir de France y coûtent beaucoup. Les gens à plaindre sont les gentilshommes et les officiers, qui n'ont que leurs appointements et qui sont chargés de famille.... Il y a dans la Nouvelle-France plus de noblesse que dans toutes nos colonies ensemble.... La plupart de ces gentilshommes ne sont pas à leur aise. Ils y seraient moins si le commerce ne leur était pas permis et si la chasse et la pêche n'étaient pas ici de droit commun. Après tout, c'est un peu leur faute s'ils souflrent de la disette: la terre est bonne presque partout et l'agriculture ne fait point déroger. Combien de gentilshommes, dans toutes les provinces de France envieraient le sort des simples habitants du Canada s'ils le connaissaient! Et ceux qui languissent ici dans une honteuse indigence sont-ils excusables de ne pas embrasser une profession que la seule corruption des mœurs et des plus saines maximes a dégradée (en France) de son ancienne noblesse".

Charlevoix dit encore "Plusieurs des officiers du régiment de Carignan avaient obtenu des terres avec tous les droits[1] de seigneurie. Ils s'établirent presque tous dans le pays, s'y marièrent et leur postérité y subsiste encore (c'est-à-dire vers 1720). La plupart étaient gentilshommes, aussi la Nouvelle-France a-t-elle plus de noblesse

[1]Droits de seigneurie en Canada, bien autrement doux que ceux de France. Voir Société Royale, 1913, I. 156, 159.

ancienne qu'aucune autre de nos colonies, et peut-être que toutes les autres ensemble."

"Il n'y a dans ce pays, aucune seigneurie, mêmes celles qui sont titrées, à laquelle le droit de patronage soit attaché, car sur la prétention de quelques seigneurs, fondée sur ce qu'ils avaient fait bâtir l'église paroissiale, Sa Majesté, étant en son conseil, prononça, en l'année 1685, que ce droit n'appartenait qu'à l'évêque, tant parce qu'il est plus en état qu'aucun autre de juger de la capacité des sujets, parce que la portion congrue des curés est payée par les dîmes, qui appartiennent à l'évèque. Le roi, dans ce même arrêt, déclare que le droit de patronage n'est point censé honorifique."

L'intendant Hocquart disait, en 1736 "Tous les gentilshommes et enfants d'officiers désirent entrer dans le service, ce qui est louable en soi, mais comme la plupart sont pauvres, plusieurs y entrent pour y trouver une petite ressource dans la solde du roi, plutôt que pour d'autres motifs. M. le gouverneur général (Beauharnois) choisit les meilleurs sujets. On a de la peine à engager les autres à faire valoir des terres. Peut être conviendrait-il d'en faire passer quelques uns en France pour servir dans la marine, afin de s'attacher de plus en plus la noblesse et les gens du pays".

La création d'une classe supérieure qui, d'après les calculs de Louis XIV, Colbert, Talon et autres, devait se tenir au premier rang de la colonie, n'a été qu'une œuvre factice et son utilité n'a pu se faire sentir qu'à la guerre. On ne saurait dire que la conquête l'a anéantie puisque, dès lors, ou la voyait se dissoudre et que les fils de l'habitant prenaient partout le haut du pavé. Le cultivateur a rempli les vides laissés dans l'édifice social à mesure que la noblesse s'effondrait. Il n'y a pas eu de bouleversement mais plutôt une substitution.

Le régime français ayant été aboli au Canada par le traité de 1763 sans faire d'exception pour les titres de noblesse, l'administration britannique aurait été justifiable de les méconnaître, toutefois elle ne fit rien pour les gêner. Comme ils ne comportaient, dès leur origine, aucun privilège, il devenait facile de fermer les yeux sur leur compte. Néanmoins, plusieurs familles nobles exerçaient par ellemêmes une influence que le nouveau pouvoir jugea à propos de ne point négliger. Durant un quart de siècle ces familles reçurent des politesses spéciales, puis tout s'effaça.

En France, les privilèges de la noblesse ont été abolis par la révolution de 1789.

Au Canada, ces privilèges n'existant point, restait donc, comme autrefois, la qualification de gens nobles—tranquillement, depuis un siècle, elle s'est éteinte et c'est à peine si les descendants des familles de cette classe y pensent encore de temps à autre.

Le règne de la Compagnie de la Baie d'Hudson.

1821—1869.

PAR L'HON. JUGE L. A. PRUD'HOMME.

(Lu le 29 Mai 1913)

Notes préliminaires.

Après une tourmente de 37 ans, l'Ouest put enfin respirer en paix et jouir des bienfaits d'un règne paisible. L'ère des convulsions périodiques et des guerres fratricides se termine en 1821.

Les factions disparaissent et les mauvaises passions s'assoupissent. Désormais la civilisation va pouvoir suivre sa marche ascendante dans le pays.

L'ordre et le respect des lois vont reprendre leur empire. Toutes les énergies concentrées dans les mains d'une organisation unique travaillent dans un harmonieux concert au développement de cette immense région. Sans doute, les efforts dans ce sens, ne seront pas toujours couronnés de succès. Bien des tentatives d'utilité publique seront frappées de stérilité et avorteront faute de capitaux ou de moyens d'exportation, mais enfin une amélioration sensible se fera sentir.

Il faudra attendre la construction de voies rapides pour assister à un essort véritable. Dieu qui avait des desseins de miséricorde sur ce pays, amène l'union des traiteurs, pour faciliter les voies à ses apôtres. Pendant que la compagnie de la Baie d'Hudson érige ses forts et moissonne des fourrures, les missionnaires s'en vont élever à côté d'eux leurs humbles chapelles, pour moissonner des âmes.

C'est ainsi qu'inconsciemment, cette compagnie contribua à l'œuvre d'évangélisation et à la diffusion de la vérité. Alors que les commerçants amassent des richesses périssables, les envoyés du Christ, font des conquêtes pour le ciel et transforment le caractère et les mœurs des pauvres Sauvages. L'homme de la prière visite sous des misérables loges les tribus plongées dans les ténèbres du paganisme le plus grossier, esclaves de honteuses passions et avilies par de criminelles habitudes. Il les instruit, les relève de leur abaissement, fait briller à leurs yeux les admirables doctrines du catholicisme et fait descendre dans leur âme les suaves consolations de la religion.

Des idées nouvelles germent au sein de ces barbares et l'on sait que ce sont les idées qui en définitive gouvernent le monde.

Sans doute ce riant tableau présente des ombres.

La compagnie d'ordinaire facilitera les efforts des missionnaires mais, çà et là, quelques bourgeois imbus de fanatisme et de préjugés étroits, chercheront à gêner l'action bienfaisante des missionnaires et à indisposer les Sauvages contre eux.

Ces cas exceptionnels ne serviront qu'à stimuler leur zèle et à faire triompher avec plus d'éclat la noble cause à laquelle ils ont consacré leur existence.

A la tête de ces intrépides conquérants du Christ apparaissent les Provencher, les Taché, les Grandin, les Faraud et les Clut, pour ne parler que des morts.

L'ombre de ces vaillants athlètes plane encore sur ces territoires où ils ont traîné leur glorieux martyre au service du Bon Maître. Ils sont tombés dans l'arène, brisés par la souffrance mais couverts de mérite, heureux de donner jusqu'à leur dernier soupir pour agrandir le royaume de Dieu.

Les illustres fils de Mazenod s'avanceront jusqu'au cercle polaire pour évangiliser les Esquimaux et on apprendra, un jour, avec une émotion empoignante que l'un d'eux perdu dans ces affreuses solitudes, demandera, sans pouvoir l'obtenir, une pomme de terre, comme suprême faveur aux dernières heures de son existence.

Le spectacle grandiose de tels sacrifices nous réconforte dans les jours de lutte, nous les héritiers de ces héros de la foi, et nous console dans les moments de détresse.

La foi implantée par des mains si généreuses peut bien être ébranlée par l'orage, mais elle a des prises trop profondes dans le sol et a été arrosée par des sueurs trop fécondes pour défaillir. Deux grands évêques ont gouverné l'ouest pendant la période qui nous occupe et l'embrassent toute entière.

Monseigneur Provencher, arrivé ici le 16 juillet 1818, fut consacré évêque le 12 mai 1822 et mourut le 7 juin 1853.

Monseigneur Taché atteignit la Rivière Rouge le 25 août 1845, fut préconisé le 24 juin 1850 et s'endormit dans le seigneur le 22 juin 1894. Le premier compte 31 années d'épiscopat et le second quarante quatre.

Pendant leur long épiscopat, ils ont fondé des maisons d'éducation et de charité, établi des paroisses, pourvu à tous les besoins de cette église naissante, appelé à leur aide des congrégations religieuses et jeté en terre la semence des institutions catholiques. Leur intrépide successeur a fécondé cette sève généreuse et lui a donné depuis la merveilleuse floraison qui fait en ce moment notre légitime orgueil.

L'illustre prélat qui occupe aujourd'hui le siège archiépiscopal de Saint-Boniface s'est montré vraiment le digne successeur des Pro-

vencher et des Taché. Je ne sache pas qu'on puisse enchérir sur ce témoignage que lui doivent la gratitude et l'affection des catholiques de l'ouest.

Pendant toute leur vie, ces prélats ont combattu pour la vérité la justice et la liberté, les plus grandes choses de ce monde. Ces conquérants des âmes n'ont fait couler que des larmes de tendresse et d'admiration. Pour rendre justice à leur mémoire, il faudrait m'arrêter à chaque page. Ce travail a déjà été fait par deux prêtres distingués et me dispense d'insister.

Je me contenterai d'ajouter que nos deux premiers évêques faisaient partie du conseil d'Assiniboia et comme tels ont exercé sur l'admiration législative du pays une influence considérable pour le bien.

Leurs hautes facultés intellectuelles et la noblesse de leurs sentiments ont contribué à faire régner la concorde et la justice dans la colonie naissante.

L'Etat comme l'Eglise ont profité de leurs merveilleux talents et lui doivent une vive gratitude pour les services qu'ils ont rendus.

La période historique qui fait l'objet de cette étude n'a produit en réalité que deux événements qui tranchent sur l'ordinaire. De fait, ils ont apporté des changements sérieux dans la colonie. En 1835, le territoire d'Assiniboia, c'est à dire 60 milles ayant pour point de départ le fort Garry, fut séparé du reste de l'ouest et placé sous le contrôle d'un conseil spécial qui devint la première chambre législative du pays.

En 1849 le procès de Sayer souleva l'indignation des Métis. Ils arrachèrent l'accusé des mains des tribunaux et proclamèrent la liberté de la traite.

De ce jour les Métis purent traiter avec les Sauvages sans être molestés par la compagnie qui se soumit à l'inévitable et accepta le fait accompli.

Le faisceau des autres faits et gestes de cette époque, sans manquer d'intérêt, n'offre rien de bien saillant.

Le Gouverneur Sir George Simpson.
Gouverneurs Généraux et d'Assiniboia.
Conseil des Facteurs.

Après la mort de Selkirk, les traiteurs des deux compagnies rivales cherchèrent une entente. L'honorable Edward Ellice contribua plus que tout autre à préparer l'union des deux compagnies. Cette union fut cimentée le 26 mars 1821 et sir George Simpson eut l'honneur d'être choisi pour diriger cette vaste corporation.

Il gouverna l'ouest de 1822 jusqu'à la date de sa mort en 1863, soit 41 ans. Il avait débuté comme simple commis au lac Athabasca en 1820 et avait visité la rivière La Paix.

Il séjourna surtout au fort Wedderburn. Le jeune Simpson avait servi pendant quelque temps dans le bureau de la compagnie de la Baie d'Hudson à Londres. Andrew Colville qui était allié à lord Selkirk et faisait partie du bureau de direction, avait remarqué les talents et l'activité administrative de ce jeune homme. Il l'envoya dans l'ouest faire son apprentissage sur les lieux, après l'avoir désigné pour être bientôt le représentant autorisé de la compagnie.

Simpson était gros, trapu et vigoureux, plein de verve et d'entrain, prompt à embrasser une situation et à décider sur le champ ce qu'il y avait à faire.

Tous les ans, il partait de Lachine au petit printemps et visitait le pays. Il présidait à l'assemblée des bourgeois, règlait dans ce conseil général toutes les questions pendantes et la conduite de chacun à l'avenir.

Quelquefois il traversait même les Montagnes Rocheuses pour visiter les postes de la Colombie Anglaise.

A l'automne il retournait à Montréal, à l'exception d'une couple de fois qu'il hiverna au fort Garry. C'était un voyageur infatigable. dûr pour lui-même et pour les pauvres canotiers qui l'accompagnaient, Le canot ne glissait jamais assez vite à son gré. Il épuisait ses rameurs. La patience était la moindre de ses vertus.

Un jour qu'il traversait le lac La Pluie avec un Canadien-Français, il se mit à l'accabler de reproches amers parceque la course n'était pas assez rapide. Poussé à bout, ce brave homme saisit le gouverneur dans ses bras et le plongea une couple de fois dans le lac, pour refroidir sa mauvaise humeur et les pétulances de son caractère et le replaça ensuite au fond du canot.

Simpson comprit la leçon et eut le bon esprit de n'en pas tirer vengeance. Doué d'un esprit supérieur, il se montait d'ordinaire autoritaire et impérieux. Il ne faisait pas bon de lui résister en face et même de l'obliger à répéter deux fois le même ordre. Par ailleurs, il ne manquait pas de sentiments généreux. Il fit don à monseigneur Provencher de cent louis pour l'aider à construire sa cathédrale.

Simpson avait le titre de gouverneur général et avait sous sa juridiction le gouverneur de la colonie d'Assiniboia; c'est à dire que son autorité couvrait tout le pays depuis le lac Supérieur jusqu'aux côtes du Pacifique.

Il avait pour voisin le Czar de Russie et était comme lui revêtu d'un pouvoir absolu.

Il n'y eut dans l'ouest que trois gouverneurs généraux; les voici avec l'indication de la durée de leur règne.

Sir George Simpson..........................	1821–1863
Alexandre G. Dallas.........................	1863–1864
William McTavish............................	1864–1869

Les gouverneurs d'Assiniboia qui n'avaient d'autorité que dans la colonie de ce nom, furent beaucoup plus nombreux. On en compte quatorze.

Je donne la liste complète de tous ceux qui ont agi comme tels.

1. Capitaine Miles Macdonnell.............	1812–1815
2. Robert Semple..........................	1815–1816
3. Alexandre McDonell.....................	1816–1822
4. Capitaine A. Bulger....................	1822–1823
5. Robert Pelly...........................	1823–1825
6. Donald McKenzie........................	1825–1833
7. Alex Christie..........................	1833–1839
8. Duncan Finlayson.......................	1839–1844
9. Alex. Christie (2e terme)..............	1844–1846
10. Colonel Crofton.......................	1846–1847
11. Major Griffiths.......................	1847–1848
12. Major Caldwell........................	1848–1855
13. Juge Johnson..........................	1855–1859
14. Wm. McTavish..........................	1859–1869

Presqu'à tous les ans, le gouverneur général réunissait les principaux officiers pour prendre en considération les affaires de la compagnie.

D'ordinaire les facteurs en chef avaient seuls le droit d'assister à ces assemblées et de prendre part aux délibérations. Le premier conseil fut tenu en 1830. Il se réunit deux fois en 1836; par contre, il n'y eut pas de convocation pour les années de 1834-1838-1839-1853-1872-1873-1884-1885 et 1886.

De 1830 à 1887, date à laquelle je m'arrête, le conseil fut réuni 50 fois. Jusqu'en 1830, le conseil siégeait le plus souvent à Norway House. Il n'en fut pas ainsi après.

Les facteurs en chef s'assemblèrent 21 fois à Norway House; 10 fois à Carlton, 8 fois à la Rivière Rouge, 4 fois à la factorerie de York; 4 fois au fort Garry d'en bas (Fort de Pierre) une fois à Prince Albert et une fois à Winnipeg.

Ces assemblées furent présidées successivement par sir George Simpson, D. Finlayson senior facteur en chef, Eden Colville, gouverneur d'Assiniboia, Edward McTavish, en sa qualité de gouverneur

par intérim et ensuite comme gouverneur des terres de Rupert; A. G. Dallas, gouverneur en chef; D. A. Smith, senior facteur en chef; Robert Hamilton facteur en chef et inspecteur; James A. Grahame commissaire en chef et Joseph Wrighly comme commissaire. Le gouverneur en chef avait sous sa dépendance le gouverneur de la colonie d'Assiniboia et tout l'ouest jusqu'aux Montagnes Rocheuse, ainsi que ce qui constituait autrefois le district de Keewatin. Quand il se trouvait dans la colonie, il avait préséance sur le gouverneur d'Assiniboia et présidait le conseil d'Assiniboia. Bien plus, les membres du conseil des terres de Rupert étaient *ex officio* membres du conseil d'Assiniboia et de fait en 1849 Ballendine et Black y siégèrent parceque leur nomination de conseiller pour les terres de Rupert les constituait *de jure* conseillers d'Assiniboia.

Nos premières paroisses et l'ancienne population du pays

En 1822, Mr. Halkett, beau-frère de Lord Selkirk visita la colonie et demanda à Mgr. Provencher d'abandonner l'établissement de Pembina. Mgr. se rendit à sa demande.

Il est probable que le voisinage de la frontière faisait craindre à la compagnie de la Baie d'Hudson que les Métis se livrent à la traite. Or, à cette époque, elle réclamait le monopole du commerce des fourrures, en vertu de sa charte.

Il y avait bien également un autre motif pour s'éloigner de cet endroit. Les Sioux infestaient la prairie autour de ce poste et de temps à autre enlevaient des chevelures.

Ces cruels brigands ne respectaient ni l'age ni le sexe et plus d'une fois ils ensanglantèrent nos plaines.

La présence des missionnaires à la Rivière Rouge détermina les Métis à se fixer au sol. Nos premières paroisses datent de cette époque. Mgr. Provencher se préoccupa dès son arrivée de fonder des écoles à Saint-Boniface. Plus tard d'autres furent ouvertes ailleurs. Le clocher de la modeste chapelle attira la population. Peu à peu Saint-Boniface, Saint-Vital, Saint-Norbert sur la Rivière Rouge et Saint-François-Xavier et la Baie Saint-Paul sur l'Assiniboine, virent les anciens voyageurs de l'ouest élever leurs primitives chaumières de bois équarri, avec couvertures de torchis de foin mêlés à l'argile et se livrer à l'élevage et à la culture des champs. Ce groupement facilita l'œuvre des missionnaires et fut l'origine d'une prise de possession réelle de ces plantureuses vallées. Ce fut le noyau principal de la population catholique de l'ouest.

Les Métis furent les premiers nés à la foi, dans cette partie du Canada. De tout temps ils entourèrent le clergé de respect et d'af-

fection. Ils servirent d'interprètes aux missionnaires parmi les tribus sauvages et devinrent ainsi leurs auxiliaires aussi fidèles que dévoués. Honnêtes, hospitaliers, généreux, partageant volontiers leur dernier morceau de pain avec les hôtes qui venaient s'asseoir à leurs foyers, les anciens du pays ont rendu des services signalés à l'Eglise. Il n'est que juste de leur rendre ce tribut de gratitude.

Leur ascendant sur les Sauvages, qui les considéraient comme leurs alliés naturels, facilita également l'établissement des blancs au milieu d'eux et les rapports de la compagnie de la Baie d'Hudson avec les aborigènes.

Comme guides, ils étaient incomparables. Ils possédaient instinctivement la faculté de s'orienter au milieu des prairies comme le pilote au sein de l'Océan. Leur endurance aux fatigues et leurs ressources ingénieuses dans les situations imprévues des déserts et des forêts, les faisaient rechercher comme guide et voyageur. La compagnie les utilisa pour diriger les caravanes qui allaient fréter dans les postes échelonnées jusqu'au pied des Montagnes Rocheuses. Ils en rapportaient les ballots de pelleterie qui prenaient le chemin de la Baie d'Hudson.

D'autres servaient de bateliers sur les fameuses berges (York boat) qui, à tous les ans, partaient du fort Garry et se rendaient jusqu'au portage La Loche. A ce dernier poste, la brigade du fleuve Mackenzie venait au jour indiqué les rencontrer et échanger les fourrures précieuses du grand Nord pour des marchandises de traite. Les bateliers revenaient ensuite à Norway House déposer les fourrures qui l'été suivant descendaient la rivière Nelson jusqu'à la mer.

Ce long voyage, aller et retour, se faisait durant le même été. C'était un veritable tour de force. Il fallait des hommes du métier, bardés de fer, pour résister à un tel surménage.

Un autre groupe de Métis se livrait aux chasses légendaires du buffalo. Deux fois l'an, ils se rendaient par gros camps dans la prairie. Ils revenaient en juillet, pour faire leurs foins, emportant dans leurs charettes en bois des sacs de pemmican. Ils retournaient à l'automne pour revenir aux premières neiges, avec la chair du buffalo sans apprêt, que les froids leur permettaient de conserver jusqu'au printemps.

On a souvent reproché aux Métis d'avoir négligé l'agriculture. Il est certain que la chasse avait pour eux un entraînement invincible. Elle constituait pour eux un héritage de naissance. Ce reproche toutefois est mal fondé. Tout d'abord qu'auraient-ils pu faire avec des récoltes abondantes. La compagnie n'achetait que le blé qu'il lui fallait pour alimenter ses forts.

On ne pouvait songer alors à exporter le grain ou la farine. Il n'y avait pas d'autre marché que celui de Saint-Paul. Les frais de transport en charette se seraient élevés à dix fois la valeur du grain. Et puis, pourquoi tant peiner, quand la vie était si facile au bout du fusil. Les lacs et les rivières regorgeaient de poisson.

Pour juger sainement de cette population, il faut se reporter par la pensée aux conditions économiques de ce temps-là, autrement on risque fort de tomber à faux et d'être injuste.

Il y a bien des choses d'antan qui, si elles étaient à refaire avec les mêmes moyens, se recommenceraient de la même façon, parce qu'elles étaient les plus en rapport avec les besoins et les ressources du pays.

On ne comprend plus aujourd'hui ces temps primitifs, parce qu'on ne s'inspire pas de son histoire et qu'on ne se pénètre pas assez du peu de moyens à la disposition du pays.

Je veux bien qu'on se pâme d'admiration sur la marche des progrès actuels et des développements prodigieux de l'ouest. Qu'on s'en donne à son aise, je n'ai rien à dire. Pas n'est besoin pour cela d'anathématiser un passé qui a eu ses charmes et ses mérites et qui a préparé le présent. Autre temps, autres mœurs.

Premiers Colons.

Après l'union des deux compagnies, la moitié des serviteurs fut renvoyée; les nouvelles conditions de la traite n'exigeaient plus leur service. Ils vinrent pour la plupart se fixer sur des terres près de la mission de Saint-Boniface et fortifièrent ainsi le noyau des traiteurs libres déjà établis.

En 1827 cent cinquante personnes arrivèrent de l'ouest et donnèrent des développements à cette paroisse naissante.

Lorsque Mgr. Provencher abandonna Pembina en 1823, un grand nombre de Canadiens se voyant sans missionnaires allèrent s'établir sur les bords de l'Assiniboine.

Ce fut l'origine de la paroisse de Saint-François-Xavier. Dès lors les colons catholiques constituèrent la majorité et ils conservèrent la prépondérance jusqu'en 1870. Ces braves gens n'élevaient pas à cette date des demeures bien somptueuses. Leurs chétives cabanes ne consistaient que de bois équarri couvert de perches et de foin. On n'y trouvait ni vitre ni poële. Les chassis étaient fermés avec des parchemins ou peaux; une cheminée en terre tenait lieu de calorifère et de ventilateur. La compagnie de la Baie d'Hudson était loin de s'inspirer de la pensée et des projets de Selkirk. Elle négligea la colonisation pour s'occuper de la traite et des gros profits qu'elle rapportait.

Traiteur Hesse—Concession de lots.

En 1822 un traiteur du nom de Hesse, qui avait épousé une Sauteuse, partit pour la chasse avec deux de ses filles. Les Sioux profitant de son absence massacrèrent l'une d'elles et amenèrent l'autre captive.

Hesse était un brave. Il partit seul, se rendit sur le Missouri, où il se présenta devant le camp sioux qui retenait son enfant. Les Sauvages frappés d'admiration à la vue d'une telle audace et du dévouement paternel de cet homme, lui rendirent sa fille que d'ailleurs ils avaient respectée.

La même année, la compagnie fit arpenter les terres et leur donna dix chaînes de front. Elle concéda gratis à chaque colon cent acres et fixa l'excédant à cinq chelins par acre. Plus tard elle éleva le prix à 12 chelins pour le réduire à 7 chelins en 1835.

Gouverneur Bulger—Sa fermeté.

En 1823 le gouverneur Bulger fut appelé à faire acte d'autorité. Les Sauvages se montraient parfois arrogants et tapageurs. Un jour l'un d'eux menaça de le frapper de son couteau. Le gouverneur pour donner un exemple le fit fouetter.

Le chef de sa tribu voulut faire un mauvais parti au gouverneur et lui demanda compte de sa conduite. Le gouverneur tint ferme et lui fit dire que s'il ne changeait pas de ton, il allait lui en donner autant. Il se le tint pour dit et tout rentra dans l'ordre. Cette leçon produisit un bon effet sur l'esprit des Sauvages qui de ce jour se montrèrent plus déférents envers l'autorité.

Chasseurs de 1825—Inondation de 1826.

En 1825 les chasseurs de buffalo furent douloureusement éprouvés. Une tempête de neige chassa les troupeaux de buffalo au mois d'octobre et laissa les chasseurs dans une situation décourageante. Se mourant de froid et de faim, ils reprirent le chemin de la Rivière Rouge. Après avoir épuisé toutes leurs provisions, une trentaine d'entre eux périrent dans la prairie. L'année suivante un autre fléau devait fondre sur la colonie. La Rivière Rouge déborda de tous côtés. La glace encore ferme se mit en mouvement, détruisant sur son passage les bâtisses des colons. Les Métis se réfugièrent sur les hauteurs de Silver Heights et les Ecossais à Birds' Hill.

La rivière ne rentra dans son lit que le 20 juin. Deux cent cinquante-trois personnes découragées à la vue de ces ruines quittèrent le pays et allèrent s'établir aux Etats-Unis. Le plus grand nombre de ces émigrants étaient Ecossais.

Fort Garry—Thomas Simpson et Larocque. Revd M. Belcourt apaise les Métis.

L'événement le plus considérable à noter après l'inondation est la construction du fort Garry qui fut terminé en 1834. Ce fort, était le plus imposant du pays. Il avait 260 pieds carrés et était flanqué de quatre bastions aux angles. Des meurtrières et des canons pouvaient, au besoin le protéger. Il reçut une triste étrenne, l'automne même qu'il fut terminé.

Un jour, un commis du nom de Thomas Simpson était occupé à payer les serviteurs de la compagnie. C'était le jour de la paie et la foule l'assiégeait. Un nommé Larocque qui attendait son tour depuis quelque temps, demanda avec un peu de sans-gêne d'être payé sur le champ. Simpson perdit patience et lui asséna un coup de tisonnier sur la tête. Couvert de sang, il sortit du fort et se montra aux autres Métis, qui résolurent d'en demander compte au coupable. Ils se réunirent en nombre et exigèrent qu'on leur livrât Simpson. Le gouverneur Christie chercha en vain par mille moyens à les apaiser. Voyant qu'il ne gagnait rien et que la situation devenait périlleuse, sinon desespérée, il s'adressa au Révérend M. Belcourt pour lui venir en aide dans cette extrémité. Ce missionnaire qui jouissait d'un grand crédit auprès des Métis, se rendit aussitôt au fort et réussit à les pacifier. Ces derniers se contentèrent d'un dédommagement pécuniaire pour la famille du blessé.

Requête des Métis et le Gouverneur Christie.

En 1835 les Métis encouragés par le succès de l'année précédente, se rendirent de nouveau au fort, pour obtenir une réduction des droits de douane sur les marchandises importées des Etats-Unis.

Pour se soustraire au monopole de la traite, les Métis avaient l'habitude de traverser la frontière et de se rendre sur le Mississipi où ils échangeaient leurs fourrures pour des marchandises américaines. Ils en retiraient des profits deux fois plus élevés qu'à la Rivière Rouge.

Le gouverneur Christie était un fin diplomate; il fit de belles promesses et réussit à retarder l'orage pour le moment. Pour terminer ce tableau succinct des faits qui se produisirent avant 1835, il me reste à dire quelques mots des missionnaires.

Mgr. Provencher—Education—Missions et Missionnaires

Mgr. Provencher dès son arrivée en 1818 ouvrit une école pour les garçons. Malgré tous ses efforts, il ne réussit qu'en 1829 à obtenir une école pour les jeunes filles. Elle fut confiée aux Delles Nolin. Ce

ne fut qu'en 1844 que les Sœurs Grises arrivèrent dans la colonie et purent se charger de ce soin. En 1830 Mr. Belcourt commença à donner des missions chez les Sauvages. Il composa une grammaire et un dictionnaire sauteux qui facilitèrent beaucoup la tâche de ses successeurs. Voici l'ordre chronologique des principales missions de cette époque. Baie St. Paul 1833; Wabassimon 1838; lac la Pluie 1840; lac Manitoba 1841; fort des Prairies (Edmonton) et lac Ste. Anne, par M. Thibault 1842; île à la Crosse, portage la Loche, Petit lac des Esclaves et rivière La Paix 1844-1845.

Mr. Thibault fut le doyen du clergé séculier au Nord-Ouest. Il eut l'honneur d'être le premier apôtre de la Saskatchewan et du lac La Biche. En 1845 le P. Aubert et le frère Taché arrivaient au pays. Ils furent l'avant-garde de ce bataillon sacré de zèlés missionnaires qui ont évangilisé tout le nord-ouest et continuent encore à répandre les lumières de l'évangile jusqu'au cercle polaire. J'ai nommé les fils de Mgr. de Mazénod, les P.P. Oblats de Marie Immaculée. En 1846 M. Laflèche et le P. Taché se rendirent à l'île à la Crosse qui devaient être pour tous deux la première étape de la carrière si fructueuse qui les attendait.

Les misères de ces lointaines missions trempèrent leur courage et les armèrent pour les luttes futures d'un long épiscopat.

LE CONSEIL D'ASSINIBOIA 1835–1869.

Mouvement Populaire.

Nous voici arrivés à la première ébauche d'un gouvernement représentatif, au seuil de la première chambre d'assemblé politique. Il faudra attendre encore 35 ans avant l'épanouissement complet d'un gouvernement constitutionnel. L'année 1835 n'inaugure que la première éclosion d'un mouvement populaire qui ne recevra son développement entier qu'en 1870.

En 1849 Louis Riel père arrachera violemment des mains de la compagnie de la Baie d'Hudson le monopole de la traite et aura l'honneur de doter le pays de la liberté commerciale. Son fils en 1869, marchant sur ces traces, ramassera le pouvoir échappé des mains du gouverneur McTavish et couronnera son œuvre. Il forcera l'autorité fédérale de négocier avec le gouvernement provisoire qu'il aura établi et n'abdiquera qu'après que les mesures de justice qu'il aura réclamées auront été revêtues de la signature du représentant de la Couronne.

Composition du Conseil.

En 1835 sir George Simpson se conduisit en diplomate clairvoyant et habile. La création d'un conseil pour le territoire d'Assi-

niboia lui permit de fortifier son autorité, en s'entourant des hommes les plus distingués et les plus honorables de la colonie. Il espérait, par ce moyen, apaiser les mécontentements que faisaient naître le prix des terres, les impôts douaniers sur les importations des Etats-Unis et le monopole de la traite.

La compagnie se réservait le contrôle effectif de ce corps car les conseillers, quoique nommés à vie, étaient tous choisis par le bureau des directeurs, à Londres.

En réalité le conseil fut constitué d'après les suggestions du gouverneur. Voici les noms des premiers conseillers:

Sir George Simpson, gouverneur en chef, président.
Alex. Christie, gouverneur d'Assiniboia.
Monseigneur J. N. Provencher, évêque de Juliopolis.
Revd. D. J. Jones, chapelain de la compagnie.
Revd. William Cochrane, assistant-chapelain.
James Bird, bourgeois de la Cie.
James Sutherland, bourgeois de la Cie.
W. H. Cook, bourgeois de la Cie.
John Pritchard, écuier.
Robert Logan, marchand.
Alexander Ross, shérif d'Assiniboia.
James McCallum, coroner.
John Bunn, médecin.
Andrew McDermot, marchand.
Cuthbert Grant, préfet des Prairies.

Ces deux derniers étaient catholiques. La population française ne reçut point dans la composition du conseil la proportion à laquelle elle avait droit.

La présence de Mgr Provencher et son influence dans cette assemblée étaient cependant une garantie que les nôtres seraient respectés.

Législation du Conseil.

Le 12 février le gouverneur convoqua le conseil pour la dépêche des affaires. Il ouvrit la séance par un discours dans lequel il insistait sur la nécessité de rendre l'administration de la justice plus efficace et d'adopter des mesures pour réprimer les actes de violence qui pourraient menacer la paix et le bon ordre au sein de la colonie.

Le conseil se hâta de diviser le territoire en quatre districts judiciaires, présidés par des magistrats qui avaient juridiction jusqu'à $25.00. Au dessus de ce tribunal se trouvait la cour générale qui entendait toute cause audessus de cette somme. Les procès criminels ainsi que les poursuites pour un montant excédant $50.00

étaient jugés par la cour générale assistée d'un jury. Le conseil organisa également un corps de 60 volontaires qui faisaient la parade une fois par mois.

Ces volontaires étaient chargés de venir au secours de l'autorité civile, le cas échéant.

Il fut résolu de construire un palais de justice et une prison. Ce dernier édifice indiquait que la civilisation faisait des progrès à la Rivière Rouge, pour me servir d'une expression de Mark Twain. L'élément français fut successivement représenté dans le conseil par nos Seigneurs Provencher et Taché, Cuthbert Grant, François Bruneau, qui remplit aussi la charge de magistrat, Pascal Breland, Salomon Hamelin, Roger Goulet, Henry Fisher et John Dease.

MM. Blanchet et Demers.

En 1837 MM. Blanchet et Demers arrivèrent à la Rivière Rouge en route pour les côtes du Pacifique.

Les Canadiens de cette lointaine contrée, qui avaient pris du service dans la compagnie de la Baie d'Hudson, avaient fini par se fixer dans cette contrée. Ils s'adressèrent à Mgr Provencher pour obtenir des missionnaires. Cet illustre prélat n'avait pas lui-même assez de prêtres pour ses propres besoins. Il n'hésita pas néanmoins à s'adresser au clergé de la province de Québec pour cette nouvelle mission. Ces deux prêtres zélés répondirent à son appel. M. Blanchet devint le premier évêque de l'Orégon et Mr. Demers de Vancouver. C'est ainsi que Saint-Boniface peut se féliciter d'avoir contribué dans une large mesure à la fondation des deux premiers diocèses de cette région.

Mort tragique de Thomas Simpson.

Nous avons déjà fait connaissance avec Thomas Simpson qui en 1834 avait failli tuer Larocque.

Cet homme devait encore faire parler de lui.

En 1840 il revenait de l'extrême nord, où il avait fait une importante exploration. Il avait hâte de se rendre en Angleterre pour présenter son rapport. Afin d'arriver plus tôt que ses compagnons qui avaient pris la route ordinaire des canots, il résolut de traverser les prairies jusqu'à Saint-Paul.

Il organisa une caravane, mais pressé de se rendre, il prit les devants avec Antoine Legros, son fils, John Bird et James Bruce. Les guides qui l'accompagnaient remarquèrent qu'il dormait peu, qu'il agissait d'une manière étrange, prononçait des paroles incohérentes et que sa raison était ébranlée. Le 4 juin au soir, Simpson dans un moment d'aliénation mentale coucha en joue Legros et Bird

et les tua tous deux. Les deux survivants crurent prudents de se sauver pour éviter le même sort. Ils allèrent rejoindre le gros du camp qui les suivait. Un parti de six hommes revint quelques jours après à l'endroit où ils avaient quitté Simpson. Ils s'approchèrent avec précaution et entendirent tout à coup une détonation. Simpson venait de se suicider.

Les témoins oculaires de cette tragédie ont raconté minutieusement ce suicide dans le temps et étaient tous d'accord dans leur témoignage. Peut-on concevoir que des historiens aient pu, longtemps après, laisser planer des soupçons sur les Métis et prétendre qu'ils ont, peut-être, été les meutriers de ce pauvre insensé. Des insinuations de ce genre sont odieuses et révoltantes et méritent d'être flétries comme une atroce calomnie qui n'a pas même l'ombre d'un fondement.

Procès de Louis St. Denis.

L'un des premiers procès entendu devant la cour générale fut celui de Louis St. Denis accusé de vol.

Il fut trouvé coupable et condamné à être fouetté publiquement en face de fort Garry. Au jour indiqué, le prisonnier fut attaché à une roue de charette, dépouillé de sa chemise et un grand Allemand se mit en frais d'exécuter la sentence. Le public fut indigné d'une punition aussi dégradante. Les Métis se mirent à crier à l'exécuteur public "Bourreau" et à lui lancer de la terre et des pierres.

L'Allemand effrayé prit ses jambes et alla s'abattre dans un trou de boue. En le voyant dans ce piteux état, la foule se mit à rire et fut désarmée.

Confiscation de fourrures—Juge Thom—Son impopularité.

A cette époque, la compagnie confisqua plusieurs ballots de fourrure achetés des Sauvages.

Un nommé Regis Laurent vit les officiers entrer de force chez lui et lui enlever toutes les pelleteries qu'ils y trouvèrent. Un autre individu du lac Manitoba, pour la même offense, fut arrêté et traîné jusqu'au fort York. On menaça de l'amener en Angleterre en cas de récidive. Ces mesures arbitraires soulevèrent les esprits.

En 1839 la compagnie fit venir du Bas-Canada M. Adam Thom, auquel elle donna le titre de recorder des terres de Rupert et d'Aviseur légal du conseil d'Assiniboia. Ce fut le premier juge du pays. Il ne manquait pas de connaissances légales mais il était loin de posséder les qualités voulues pour un tel poste.

Tout d'abord, il ne parlait pas le français, qui était la langue de la majorité de la population.

Ses antécédents dans le Bas-Canada n'étaient pas propres à le recommander auprès des nôtres.

Il s'était montré en 1837 d'une violence extrême envers les Canadiens-Français.

Ces faits ne tardèrent pas à être connus à la Rivière Rouge. Les Iroquois qui montaient le canot du nouveau magistrat, racontèrent aux Métis qu'il était l'un de ceux qui avaient fait pendre les patriotes et de se méfier de lui. On l'accueillit froidement. A tort ou à raison on l'accusa plus tard d'être partial envers la compagnie qui l'avait nommé et le payait.

De fait, certaines de ses décisions sont fort étranges.

C'est ainsi qu'au mois de février 1846, Peter Hayden plaida coupable d'homicide de John Godin.

La cour ne le condamna qu'à un chelin d'amende.

Un autre, Alex Dahl trouvé coupable de viol, en fut quitte pour un mois de prison. Il eut mieux valu suspendre la sentence et renvoyer le prisonnier sous caution que de traiter légèrement des crimes aussi graves que ceux-là.

Après le procès de G. Sayer, le juge Thom discrédité, resta quelque temps sans monter sur le banc.

La cause de Foss vs Pelly acheva de le rendre impossible. Dans ce procès retentissant, la réputation des familles les plus notables de la colonie se trouvait en jeu. Thom voulut siéger de nouveau, malgré qu'il fut témoin dans la cause. De ce jour il n'osa plus présider la cour. Il eut assez peu de dignité personnelle pour accepter la charge de greffier. Au printemps de 1854 il retourna en Angleterre, regretté de personne.

Successeurs de Juge Thom.

La cour était *de jure* présidée par le gouverneur d'Assiniboia mais le recorder était *de facto* celui qui dirigeait la procédure. Il ne pouvait en être autrement car il était le seul sur le banc qui fut versé dans la jurisprudence.

Les gouverneurs qui présidèrent la cour générale furent le major Caldwell de 1848 à 1856; F. G. Johnson de 1856 à 1858 et W. McTavish de 1858 à 1862. Après cette date le juge Black siégea seul sur le banc, quoique les membres du Conseil d'Assiniboia eussent encore conservé le droit de siéger avec lui comme Juges-Associés.

Procès de Sayer—Liberté de la traite proclamée par les Métis.

La compagnie, comme nous l'avons déjà constaté, se montrait extrêmement jalouse des droits exclusifs qu'elle prétendait posséder au sujet de la traite. Elle n'entendait pas badinage sur cet article.

A maintes reprises, elle avait poursuivi ceux qui avaient osé enfreindre ses règlements. Elle avait fait venir des soldats dans la colonie pour en imposer à la population et soutenir ses révendications.

Ces mesures vexatoires finirent par soulever les Métis qui subissaient avec peine un tel joug.

En 1849, la tempête éclata. Guillaume Sayer de Saint-François-Xavier fut arrêté pour avoir traité avec les Sauvages. Il fut admis à caution et son procès fut fixé à la prochaine séance de la cour générale. Les Métis se réunirent et décidèrent d'intervenir. Louis Riel père se mit à la tête du mouvement. Pour déjouer leurs projets, la compagnie remit le procès au jour de l'Ascension, s'imaginant que les Métis obligés d'observer cette fête religieuse, n'approcheraient pas du temple de Thémis ce jour-là. Les Metis virent bientôt le truc et assistèrent le matin à la basse-messe. Ils se rendirent au nombre d'environ 300, bien armés, au fort Garry et encombrèrent le palais de justice. Sayer fut appelé à plusieurs reprises mais ne répondit pas. Le gouverneur Caldwell qui avait hâte d'en finir et voyait bien l'impasse dans laquelle il se trouvait, proposa de référer la cause à douze arbitres choisis par les Métis. Cette proposition fut acceptée mais Riel ajouta comme condition que le procès ne devrait pas durer plus d'une heure. Les rôles étaient changés. Ce n'était plus les juges qui règlaient la procédure mais le peuple.

L'heure expirée, Riel déclara la cause terminée, Sayer acquitté et la traite libre. Les Métis l'acclamèrent et de ce jour la traite devint libre. La compagnie accepta le fait accompli et baissa pavillon devant l'opinion publique.

Pembina abandonné—Etablissement de la Montagne Tortue.

En 1851 l'honorable M. Ramsay, gouverneur du Minnesota fit un traité avec les Sauvages, par lequel il obtint d'eux la concession de tout le territoire avoisinant la frontière, moyennant la somme de trente mille louis.

Les Métis qui s'étaient établis sur les bords de la rivière Pembina dès 1820 et n'avaient cessé d'y demeurer depuis, furent ignorés dans ce traité. Ils durent abandonner les terres qu'ils occupaient depuis si longtemps et allèrent fonder avec le Révd M. Belcourt, un autre établissement à la Montagne Tortue. Pembina fut abandonné pour toujours.

Inondation de 1852.

L'année suivante (1852) une autre inondation vint porter la désolation dans la colonie. L'eau monta huit pieds plus haut qu'en 1826. Le 22 mai elle atteignit son niveau le plus élevé et commença

à baisser. Les animaux furent en grande partie emportés par le courant ainsi que les bâtisses.

Ce fut un véritable désastre, surtout dans les paroisses françaises moins boisées et par conséquent moins protégées contre l'inondation que la colonie écossaise.

Les pertes s'élevèrent, dit-on, à cent mille piastres; ce qui était une somme énorme à cette époque. De plus les colons ne purent ensemencer leurs terres cette année-là. Sans la présence de Mgr. Provencher, la plupart des colons découragés par cette catastrophe auraient quitté le pays. Il ranima leur espérance et grâce aux secours accordés par la compagnie, les terres purent être mises en culture l'année suivante.

Exploration de Dawson et de Hind:

Dès 1857 la législature du Canada jeta un regard de convoitise sur le Nord-Ouest. Pour mieux se rendre compte des richesses de ce pays, elle résolut d'envoyer quelques explorateurs chargés de recueillir des renseignements et de lui faire rapport. Cette expédition fut confiée à S. J. Dawson assisté de Henry Yuile Hind. Leur exploration dura deux ans. A leur retour ils présentèrent au gouvernement un rapport volumineux et fort détaillé. Publié en brochure on le répandit à profusion et il attira les regards des colons de l'est sur nos prairies.

Le Nor-Wester—Son influence néfaste.

Le premier journal publié à la Rivière Rouge portait le nom de "Nor-Wester" et parut en 1859. Un Ecossais du nom de Buckingham en fut le premier rédacteur. Ce journal passa successivement entre les mains de Caldwell, Ross et Schultz. Cette feuille fit un grand mal au pays en fomentant la discorde et semant la défiance et l'insubordination envers l'autorité établie. Elle battit en brèche l'influence de la compagnie de la Baie d'Hudson et en affaiblissant le respect envers les tribunaux et le conseil d'Assiniboia elle fit naître le désordre et presque l'anarchie. Elle prépara ainsi le mouvement de 1870.

Les nouveaux venus dans le pays refusaient audacieusement d'obéir aux lois et voulaient tout gouverner à leur façon.

Le Nor-Wester épousait leur cause. La population française comprit que ces brandons de discorde ne se proposaient rien moins que de détrôner les pouvoirs existant et d'établir leur règne sur leurs ruines.

On ne sera pas surpris si, en 1869, lorsque le gouverneur de la Baie d'Hudson eut abdiqué, les Métis abandonnés à leur seule force

prirent leur cause en mains et firent acte d'autorité pour empêcher les autres de les dépouiller et de les chasser.du pays.

Incendie de la cathédrale et de l'Evêché de St. Boniface.

En 1861 Mgr. Taché eut à supporter une rude épreuve. La cathédrale et l'évêché qui ne constituaient qu'une seule bâtisse furent détruits par les flammes. Rien ne fut sauvé. L'incendie n'épargna pas même les archives de l'évêché. Cette perte était irréparable et aujourd'hui encore bien des questions historiques qui se rapportent à cette époque recevraient un jour nouveau et seraient sans doute élucidées d'une manière plus satisfaisante si ces documents précieux avaient pu être conservés.

Les Sioux dans la colonie.

Parmi les embarras sérieux qui furent suscités au conseil d'Assiniboia, les Sioux méritent d'occuper la première place. Ces farouches guerriers possédaient leur territoire de chasse du côté des Etats-Unis, entre les Buttes Noires, les rives du Mississipi, la rivière des Sioux et le lac du Diable.

Ils traversaient souvent la frontière, à la poursuite des troupeaux de buffalo. Dans deux circonstances ils prirent les armes et levèrent l'étendard de la révolte contre le drapeau américain. Ils couvrirent la prairie de deuil, de sang et de ruine. Ces levées de boucliers eurent lieu en 1862 et en 1882. A cette dernière date, le fameux Bœuf Assis, après avoir défait le général Custer, se réfugia à la Montagne de Bois.

Jean-Louis Legaré eut l'honneur, par la confiance qu'il inspirait à cette tribu et la haute réputation d'honorabilité dont il jouissait parmi ces Sauvages, de décider les Sioux à retourner aux Etats-Unis. C'est à ce brave citoyen que l'ouest dut d'être débarrassé pour toujours d'étrangers si peu désirables.

En 1862, les Sioux se révoltèrent parceque les agents des Sauvages les volaient comme au coin d'un bois.

Ils s'entendaient avec les traiteurs pour détourner les argents qui leur étaient dûs en vertu des traites.

Indignés de se voir spoliés de la sorte, ils se soulevèrent au mois d'août 1862 et massacrèrent les habitants de la rivière Saint-Pierre, dans le sud du Dakota. On calcule que 5000 Sioux exaspérés par les injustices et les privations incroyables dont ils souffraient, prirent les armes. Ils égorgèrent impitoyablement près de 1500 personnes. Ils se portèrent à des horreurs indescriptibles, jusqu'à faire rôtir des enfants et crucifier des femmes.

Le colonel Flandreau, à la tête d'une bande de braves, vola au secours des colons. Il soutint un siège au fort Abercrombie et sauva la population affolée de terreur qui s'était jetée dans ses bras. Il endigua ce torrent dévastateur jusqu'à l'arrivée des troupes de l'Etat.

Les Sioux se voyant repoussés et redoutant avec raison d'avoir à répondre devant les tribunaux de leurs méfaits, se réfugièrent en Canada. Le Conseil d'Assiniboia organisa un corps de cavalerie pour protéger le pays contre ces barbares.

Le "Petit Corbeau" à la tête d'une bande arriva au fort Garry, au mois de mai 1863. Ils étaient au nombre de 500. Le Conseil fut embarrassé de ces nouveaux venus qui emportaient suspendus à leur ceinture les trophées sanglants de leurs crimes. Simpson qui venait de mourir avait eu pour successeur le gouverneur Dallas. Ce dernier permit aux Sioux d'établir leur camp à la rivière Eturgeon, à environ sept milles à l'ouest de fort Garry. Le gouverneur alla les visiter et leur distribua des provisions. Il les pressa fortement de retourner dans leur patrie. Ils refusèrent obstinément.

Plus tard, ces Sauvages se rendirent à Saint-François-Xavier et puis à la Montagne Tortue où ils demeurèrent pendant trois ans. Ce ne fut qu'en 1866, après de nombreuses assurances d'amnistie de la part des autorités américaines qu'ils consentirent enfin à nous débarasser de leur présence.

A l'automne de 1864, un autre parti de Sioux suivit l'exemple du "Petit Corbeau". Ils comprenaient 350 loges dirigées par le chef "Buffalo Debout". Le gros de la nation se fixa près du Portage la Prairie. Le 21 juin 1866, une autre bande visita le fort Garry. Elle fut bien reçue et se disposait à se retirer lorsqu'elle fut attaquée par des Sauteux du lac Rouge. Quatre Sioux tombèrent morts et le reste se dispersa.

En 1864, les habitants du Portage la Prairie, craignant le voisinage des Sioux, qui venaient souvent commettre des déprédations chez eux, demandèrent à être annexés à la colonie d'Assiniboia. Cette demande fut repoussée. Les dépenses nécessitées pour nourrir les Sioux et les contenir dans l'ordre avaient épuisé le trésor. Le Conseil, on le conçoit facilement, ne se souciait pas d'assumer de nouvelles responsabilités.

Il répondit qu'il ne pouvait étendre sa juridiction sans une autorisation du gouvernement impérial et que d'ailleurs il ne possédait ni les moyens ni la force nécessaires pour administrer un territoire plus considérable que celui qui lui était présentement confié. Les Sioux devenaient un fardeau d'autant plus lourd que le conseil ne pouvait pas leur fournir de la poudre pour faire la chasse, vu la défense formelle que leur en avait faite le gouvernement impérial.

Notes sur les Gouverneurs Dallas et McTavish.

Le gouverneur Dallas ne fit que passer à la Rivière Rouge. Ce brave homme n'était pas d'un naturel combatif. Il crut à force de sympathie et d'égards pouvoir désarmer le "Nor-Wester" et ses rédacteurs. Il leur offrit un asile au fort Garry. Sa condescendance extrême poussée jusqu'à la naïveté ne fit qu'accroître l'audace de ce journal. Il s'aperçut un peu tard qu'il avait fait fausse route. Il demanda son rappel et fut remplacé par Wm. McTavish.

Ce dernier était le type du gentilhomme et de l'homme d'affaire. Il était habile, affable, bienveillant et bien disposé envers l'élément français. Sa femme d'ailleurs était catholique. Il était plein de déférence pour Mgr. Taché. Il admirait les qualités et l'intelligence supérieure de ce grand prélat et se faisait un plaisir de le consulter sur toutes les choses importantes de la colonie.

La république de Manitoba.

Nous avons vu il y a un instant, que les habitants du Portage la Prairie avaient demandé d'être annexés à la colonie.

En 1867 un groupe d'entr'eux fonda une colonie indépendante sous le nom de "La république de Manitoba". Thomas Spence fut élu président de cette république minuscule. On lui donna quelques conseillers pour l'aider à supporter le poids de son pouvoir souverain.

La colonie d'Assiniboia ne comprenait que 60 milles tout autour du fort Garry. Le reste du pays était gouverné par la compagnie de la Baie d'Hudson en vertu de sa charte et n'avait de fait aucune forme régulière de gouvernement. Dans les principaux postes, le facteur veillait au maintien de l'ordre. Dans les forts de la Baie d'Hudson, le gouverneur assisté de deux conseillers, était chargé, d'après un règlement spécial d'administrer la justice. Le Portage la Prairie se trouvait juste en dehors de la limite ouest du territoire d'Assiniboia.

Cette république ne dura qu'un an. Le ministre des Colonies écrivit au président Spence d'avoir à se désister de ses fonctions.

Thomas Spence était un Irlandais catholique, très simpathique à la population française. C'était une homme instruit et bien disposé. Cette équipée de 1867 ne fut qu'un coup de tête qui tomba sous le ridicule.

Le Conseil d'Assiniboia discrédité—Son impuissance.

Les dernières années administratives du Conseil d'Assiniboia furent troublées par des révoltes ouvertes contre l'autorité légitime; ce qu'il y eut de plus pénible c'est que le conseil ne put sévir contre

les délinquents. Son influence ruinée par le "Nor-Wester" ne comptait plus. Les écrits néfastes de ce journal avaient fini par empoisonner l'intelligence d'un certain nombre de colons et par réduire le Conseil à l'impuissance.

Un ministre d'Headingly du nom de Corbett fut arrêté un jour pour un crime honteux. Son procès attira une foule de curieux.

Le récit pornographe de cette lamentable histoire avait du piquant. Ce scandale devint le sujet de toutes les conversations. Corbett fut trouvé coupable et condamné à la prison. Un groupe de ses amis se portèrent vers la prison qu'ils ouvrirent de force et remirent Corbett en liberté. Un mandat d'arrestation fut émané contre les auteurs de ces désordres. Une bande d'une trentaine d'hommes se présenta au gouverneur et le força d'abandonner la poursuite.

Plus tard Schultz fut condamné à la prison pour s'être opposé à la saisie de ses meubles par un huissier porteur d'un bref d'exécution dûment émané.

La même histoire se répéta. La prison fut ouverte et Schultz remis en liberté. On touchait à la fin d'un règne devenu caduque et impuissant.

Le conseil remplacé par le gouvernement de Riel.

Le 30 octobre 1869, le conseil d'Assiniboia s'assembla pour la dernière fois, pour prendre en considération une dépêche du pseudo-gouverneur McDougall.

Le dernier document signé par McTavish comme gouverneur est en date du 16 novembre 1869.

Les événements subséquents se rapportent à l'histoire des troubles de 1870. Riel et son gouvernement provisoire remplacèrent de fait et de droit le Conseil d'Assiniboia.

Le règne de la compagnie de la Baie d'Hudson n'était plus qu'une chose du passé.

LES MILITAIRES A LA RIVIÈRE ROUGE.

Les Meurons ou 37ème Régiment de Ligne.

Capitaines d'Orsonnens et Williams. Expéditions Militaires.

Les soldats licenciés de ce régiment furent les premiers colons de la rivière La Seine, près de son embouchure à Saint-Boniface. Lord Selkirk leur avait concédé à chacun un lot de 10 à 15 acres d'étendue et leur avait réservé pour le paccage de leurs bestiaux une commune ayant environ trois quart de mille de largeur sur un mille et demi de profondeur.

Bon nombre d'entr'eux parlaient le français mais l'allemand était la langue maternelle de la majorité.

Lorsque Mgr. Provencher aborda à Saint-Boniface en juillet 1818, il fut heureux d'y trouver ces catholiques et ce fut cette circonstance qui le détermina à choisir l'apôtre de la Germanie pour patron de sa nouvelle mission. Le régiment des Meurons avait été recruté originairement en Suisse, surtout dans les cantons de Vaud et Neuf Chatel qui appartiennent à la Suisse Française.

Ce nom de "Meurons" lui vint de son colonel Pierre Frédéric comte de Meurons et du fait que plusieurs officiers du régiment appartenaient à cette famille.

Les D'Odet D'Orsonnens de la province de Québec sont des descendants d'un officiers des Meurons.

Ce régiment fit la campagne d'Espagne sous Napoléon 1er. Le souvenir de leur empereur leur demeura toujours cher au cœur et ils aimaient le soir, près de l'âtre, à raconter les glorieux exploits, auxquels sous ce guerrier incomparable ils avaient pris part. Ce régiment ainsi que celui de Watteville furent fait prisonniers de guerre par les Anglais. Le régiment de Watteville fut envoyé en Egypte, contre l'armée française et stationné ensuite à Malte, Messine et autres endroits, sur la Méditerranée. Lors de la guerre avec les Etats-Unis en 1812 ces deux régiments se trouvaient à Malte. Ils consentirent à passer en Canada, sous le pavillon anglais, à la condition de n'être pas tenus de se battre contre la France.

Lors de leur passage en Angleterre, pour le Canada, on enrôla dans ces deux régiments des prisonniers français, qui préférèrent se rendre aux colonies anglaises que de languir dans les forteresses ou sur les pontons. Ils prirent part en Canada à l'engagement du fort Erié et de Snake Hill et se distinguèrent par leur belle conduite. Après la guerre, ils furent licenciés.

En 1816 lord Selkirk, désirant protéger sa colonie naissante et assurer le triomphe de ses droits, enrôla 140 soldats de ces deux régiments et mit à leur tête les capitaines D'Orsonnens et Matthy et les lieutenants Greffenried et Fauché, tous pris dans le régiment des Meurons. Le capitaine D'Orsonnens fut choisi comme commandant en chef de ce parti de guerre. Il est bon de remarquer cependant que tous les Meurons qui accompagnaient Selkirk n'étaient pas des militaires en service actif. Le contingent qui relevait des autorités militaires se composait de deux sergents et de douze soldats, sous le commandement du lieutenant Graffenried. C'était le petit corps de garde, chargé par le lieutenant-colonel Harvey, D.A.G. de protéger la personne de Selkirk. Les autres n'étaient que des soldats en retraite, engagés comme serviteurs. La distinction entre les soldats soumis

à la juridiction militaire et les soldats licenciés, s'effaça bientôt. Les réguliers se laissèrent entraîner par les licenciés. Tous ces soldats, anciens camarades de régiment, emboîtèrent le pas ensemble et acceptèrent tout naturellement les ordres de leur ancien officier le capitaine D'Orsonnens. Ils partirent de Lachine en canot et remontèrent les grands lacs.

Ils portaient l'uniforme de leur régiment afin d'en imposer davantage à ceux qui auraient été tentés de faire un mauvais parti à Selkirk. On dit même qu'ils emportaient avec eux une fournaise pour faire rougir les boulets de canon. Ce dernier détail était fort significatif. Les officiers avant leur départ reçurent du commandant des forces militaires en Canada des instructions détaillés quant aux devoirs qui leur étaient assignés. Ils ne devaient intervenir que pour protéger la personne de Selkirk et veiller à sa sûreté et ne se mêler en aucune façon aux divisions des deux compagnies rivales.

De plus, il leur était interdit de demeurer en aucun poste du territoire indien et encore moins de s'y fixer.

Ils ne constituaient qu'une escorte du noble lord et devaient le suivre et retourner avec lui.

Arrivés au fort William, le quartier général de la compagnie du Nord-Ouest, ils se déployèrent en ordre de bataille, mirent en place les deux canons qu'ils avaient amenés avec eux et s'emparèrent sans coup férir du fort. Ils firent prisonniers les principaux officiers de cette compagnie, qu'ils envoyèrent à Montréal pour y subir leur procès. Le capitaine D'Orsonnens, accompagné d'un détachement de soldats et de deux canons, se rendit ensuite au fort La Pluie dont il s'empara.

Au mois de février 1817, il se mit en route pour la Rivière Rouge. Guidé par des Sauvages, il atteignit Duluth et de là par la vallée de la Rivière Rouge, il se rendit au fort Gibraltar dont il s'empara pendant une tempête de neige. Au printemps suivant, Selkirk arriva avec le reste des Meurons et se mit aussitôt à les établir sur les terres de la rivière La Seine et dans la pointe Douglas.

En 1819 le capitaine William Williams fut placé à la tête du département du Nord des terres de Rupert. Il avait été autrefois au service de la compagnie des Indes Orientales comme capitaine de navire. A peine arrivé à la Rivière Rouge, il songea à équiper un navire de guerre, dans le but d'intercepter les canots de la compagnie du Nord-Ouest en route pour le fort William. Il transforma donc un des bateaux de la compagnie en navire de guerre et y fit monter quelques canons.

Un contingent de Meurons armés fut placé à bord et à l'ouverture de la navigation en 1819 ce petit Armada fit voile vers le lac Winnipeg et jeta l'ancre au pied des Grands Rapides.

Le gouverneur Williams attendit là, avec ses fiers Meurons, l'arrivée des voyageurs de la compagnie du Nord-Ouest. Ces derniers qui ne soupçonnaient pas le danger, ne tardèrent pas à arriver de la rivière McKenzie et d'ailleurs. Ils tombèrent dans cette embuscade. Le gouverneur Williams par ce stratagème s'empara du produit de la traite des postes du nord et fit prisonniers plusieurs officiers de cette compagnie. Les Meurons les conduisirent au fort York. C'est de cet endroit que Benjamin Frobisher s'échappa durant l'hiver pour mourir de misère à quelques jours de marche du fort de la compagnie du Nord-Ouest, sur le lac Orignal.

Cette campagne fut la dernière à laquelle les Meurons prirent part. Aucun d'eux ne se fixa au pays. Leur récolte furent détruite par les sauterelles de 1818 à 1820. Ils émigrèrent tous après l'inondation de 1826. La plupart retournèrent dans la province de Québec ou s'établirent au fort Snelling (St. Paul).

L'historien Gunn se montre très sévère envers les Meurons qu'il accuse d'être ivrognes. La vie des camps n'est pas d'ordinaire une école de sobriété et de bonne tenue et l'on comprend que les colons de Selkirk aient pu trouver ces nouveaux venus un peu turbulents. Toutefois les anciens du pays qui ont vécu avec les Meurons sont loin de corroborer le témoignage de Gunn. Leur conduite a pu se ressentir parfois de la vie trop libre de leur jeunesse, mais cet historien a eu le tort de trop généraliser ces écarts intermittents. En somme c'était de braves gens qui ne tardèrent pas à se plier aux exigences du nouveau régime dans lequel ils se trouvaient jetés.

En 1821 un autre contingent de Suisses, sous la conduite du comte d'Eusser, marchèrent sur les traces des Meurons. La plupart étaient des artisans qui n'avaient aucune notion sur la culture. Ils prirent des terres dans le voisinage de leurs compatriotes les Meurons. Bientôt ils ne formèrent plus qu'un seul groupe que la population du pays confondit sous le nom de "Suisses."

Le 6ème Bataillon—Infanterie Royale de ligne et le Colonel Crofton—Mouvements annexionnistes.

Il s'écoula près de 30 ans, après l'arrivée des Meurons à la Rivière Rouge sans que les autorités aient songé à envoyer des militaires dans cette lointaine région.

Sous le gouvernement patriarchal de la compagnie, quelques constables suffisaient à maintenir la paix. Il se produisit cependant en 1846 deux événements qui alarmèrent le gouvernement impérial et le déterminèrent à expédier sans retard un détachement de soldats comme mesure de protection. A cette époque les rapports entre

l'Angleterre et les Etats-Unis étaient fort tendus, à la suite de graves conflits au sujet de la frontière de l'Orégon.

Quelques colons mécontents de la Rivière Rouge en profitèrent pour adresser une requête au gouvernement des Etats-Unis demandant l'annexion et lui promettant leur appui au cas de guerre. Cette requête qui ne contenait que quelques noms, n'évoqua que peu de sentiments simpathiques aux Etats-Unis.

Mais le gouvernement impérial au contraire y attacha une autre signification et crut y constater des signes de mécontentement fort prononcés contre l'autorité de la compagnie.

Pour éviter un coup de tête et prévenir une effervescence, il résolut d'envoyer une petite garnison au fort Garry.

Ce détachement se composait d'une aile de 6ème bataillon d'infanterie royale et d'une escouade d'ingénieurs et de sapeurs. Ils s'embarquèrent à Cork par ordre du duc de Wellington et débarquèrent au fort York. Ils avaient pour commandant le colonel John F. Crofton et comprenaient 18 officiers, 329 soldats, 17 femmes et 19 enfants. Ils avaient avec eux 28 canons. Ils ne purent en transporter que quatre au fort Garry et laissèrent les 24 autres à York.

Le trajet de York au fort Garry dura trente jours. Ils arrivèrent à la Rivière Rouge le 7 août 1846.

Le colonel Crofton pendant son court séjour au pays devint membre du Conseil d'Assiniboia. Il agit comme gouverneur de la colonie jusqu'au mois de juin 1847, alors qu'il fut remplacé par le Major Griffiths. Crofton retourna en Angleterre au mois de juillet 1847 et l'année suivante tous ces militaires le suivirent. Ils retournèrent par la Baie d'Hudson. La cause de leur rappel était que l'entretien d'un corps aussi considérable devenait un fardeau trop lourd pour la colonie.

Les pensionnaires de 1848—Riel—Wolseley.

Le détachement de Crofton avait à peine quitté le pays que leur caserne était prise par des vieux retraités que le gouvernement impérial envoyait manger leur pension au Nord-Ouest. Ils étaient au nombre de soixante et dix. Un autre corps de 70 vétérans le suivit durant l'été de 1849. Un bon nombre de ces pensionnaires s'établirent au pays et y fondèrent des familles fort honorables.

Le major Caldwell commandait ces vieux troupiers et agit également comme gouverneur de juin 1848 à juin 1855. Les soldats de Caldwell reçurent de la compagnie 20 acres de terre en gratuité; les caporaux 30 et les sergents 40. Caldwell retourna en Angleterre au mois d'octobre 1855 et ramena avec lui 56 pensionnaires.

Le premier corps militaire que l'on trouve ensuite au pays est celui organisé par Louis Riel, président du Gouvernement Provisoire. Le 2 novembre 1869, il s'empara du fort Garry avec un parti de Métis armés. Il organisa une compagnie de gardes que commandait Ambroise D. Lépine son adjudant général et demeura en possession du fort jusqu'au 24 août 1870, alors que le colonel Wolseley y fit son entrée à la tête du 60ème régiment.

Lois de Manitoba—Statuts se rapportant au Nord-Ouest—Contrats et règlements de la compagnie de la Baie d'Hudson.

Le droit commun ainsi que les lois générales introduites dans les statuts durant les six derniers siècles, quoique souvent modifiées, forment la partie principale du droit de Manitoba. Les lois de notre ancienne mère-patrie, la France, en autant que les conditions du pays pouvaient le permettre, furent les premières en vigueur.

Elles ne se composaient guère que des ordonnances concernant la traite des fourrures et les coureurs de bois. Sur le littoral de la Baie d'Hudson, les lois militaires de la France furent celles qu'observèrent les garnisons préposées à la garde des forts.

Lorsque le pays fut cédé à l'Angleterre en 1763, les lois de cette dernière, telles qu'elles existaient le 2 mai 1670, date de la charte de la compagnie, devinrent en force. Après l'entrée de Manitoba dans la confédération, notre législature déclara le 22 juillet 1874 (c.12-38 Vict) que les lois de la province seraient celles qui étaient en force en Angleterre le 15 juillet 1870.

Du 2 mai 1670 au 22 juillet 1874 les lois anglaises n'avaient subi quant au Nord-Ouest aucune modification, sauf l'adoption de quelques règlements par le conseil d'Assiniboia, pour la régie du commerce et la conduite de ses officiers.

Les règles de la procédure avaient toutefois été modifiées dans le territoire d'Assiniboia le 11 avril 1862 et le 7 janvier 1864. Voici en quelques mots l'historique des divers statuts de quelqu'importance adoptés pour l'Ouest Canadien ainsi que des traités s'y rapportant. Je les groupe sous 13 chefs.

1. En 1690, un acte fut passé confirmant pour une période de sept ans les privilèges exclusifs de la traite, de la compagnie de la Baie d'Hudson.

2. En 1696, par le traité de Ryswick, la baie d'Hudson passa sous le drapeau de la France.

3. En 1708, 1744, 1803 et 1818, des Statuts furent adoptés par le parlement impérial pour confirmer à la Compagnie le droit de faire la traite; mais il faut bien noter ici que ces statuts n'entendaient pas

du tout ratifier le droit *exclusif* de faire la traite que la Compagnie réclamait *en vertu de sa charte.*

4. Par le traité d'Utrecht en 1713 la France céda une partie de la baie d'Hudson à l'Angleterre.

5. En 1821 la compagnie fit passer une loi impériale l'autorisant à faire la traite, pendant 21 ans, à l'ouest des Terres de Rupert.

6. En 1838 cette license lui fut renouvelée pour 20 ans.

7. Dans tous ces statuts, moins celui de 1690, où la chose n'était pas nécessaire, la compagnie prend toujours grand soin de réserver les droits qu'elle possède en vertu de sa charte, et les privilèges statuaires sont accordés sans préjudice à ces droits-là.

8. La compagnie se basait surtout sur la décision rendue par lord Jeffery dans la cause de East India Co. *vs* Lands pour soutenir ses prétentions au monopole de la traite.

9. En 1850 Lord Grey, secrétaire des colonies, prépara un rapport important dans lequel il exprimait l'opinion que le statut de Jacques 1er avait eu pour effet de détruire le privilège exclusif de la traite que réclamait la compagnie.

10. Le statut 14 Geo. 3. C. 83 (1774) définit la frontière du Canada.

11. En 1794 le traité de paix et de commerce entre l'Angleterre et les Etats-Unis fixe la frontière entre le Canada et les Etats-Unis.

12. Le statut 43 Geo. III, c. 138 (1803) autorise les tribunaux du Haut et du Bas-Canada à entendre les causes criminelles pour offenses commises dans le territoire des Indiens.

13. L'acte de 1er et 2ème Geo. IV. C. 66 (1821) étend les dispositions de l'acte précédent au territoire accordé à la compagnie de manière à donner juridiction aux cours du Haut et du Bas-Canada pour toutes les offenses commises soit dans le territoire des Terres de Rupert, qui était le domaine propre et indiscutable de la compagnie, soit dans le Territoire Indien, c'est à dire tout le pays non compris dans les terres de Rupert. Ces terres de Rupert correspondaient à peu près à l'ancien territoire de Keewatin. Cette région appartenait à la compagnie sans conteste, vu qu'elle avait occupé et pris possession de ce territoire, qui avoisinait ses forts de la Baie. Un mot maintenant des titres de propriété concédés par la compagnie et de quelques uns de ses règlements. Ses contrats ne constituaient que des baux pour 999 ans. La rente n'était que nominale et consistait en trois grains de blé d'inde payables à la Saint-Michel.

Le locataire devait dans les 40 jours se fixer sur sa ferme et continuer ensuite à y demeurer. Dans les 5 ans il devait mettre un sixième de sa terre en culture et la cultiver à tous les ans. Il s'obligeait à contribuer pour sa quote-part, aux dépenses des établissements

publics, ecclésiastiques, civils militaires ou autres et au soutien des écoles. Il devait réparer les chemins dans les deux milles de sa terre, avec ses chevaux, mais ces jours de corvée ne devaient pas excéder six jours par année.

Il devait contribuer au soutien du clergé de sa croyance religieuse en lui donnant six jours de travail avec ses chevaux à tous les ans. Il s'engageait à ne pas faire la traite ni distiller aucune liqueur, à exporter ses marchandises ou grains par le fort Nelson sur les bateaux de la compagnie et ne faire aucune importation que par la même voie; à payer 5% de douane sur les marchandises importées; de maintenir la paix dans la colonie, de se soumettre à ses règlements et de ne pas transférer ses droits sur son terrain sans la permission de la compagnie. Au cas d'infraction d'aucune de ces conditions, la compagnie se réservait le droit d'annuler le bail et de reprendre le terrain cédé.

Le 10 juin 1845, le conseil d'Assiniboia permit à tout colon d'importer de Londres une fois l'an des effets n'excédant pas en valeur $250 sans aucun impôt, à la condition que ces effets seraient transportés par les bateaux de la compagnie.

Les effets excédant en valeur ce montant payaient 20% de droit, mais la compagnie se réservait le droit de faite des remises quand ces effets n'étaient pas destinés au commerce. Toute boisson trouvée en possession d'un traiteur en dehors de la colonie d'Assiniboia pouvait être saisie et détruite par le premier venu.

Les fourrures ne devaient être achetées que directement des chasseurs.

Industrie à la Rivière Rouge—La compagnie de poil de buffalo.

Les premiers efforts pour doter le pays de manufacture ne datent pas d'hier. Ce projet ambitieux tourmentait les traiteurs dès le berceau de la colonie. C'est ainsi qu'on retrouve le plus souvent dans un pays les germes de tout ce qui est appelé à y prendre racine plus tard. Ce fut en 1822 que fut organisée la compagnie dont le nom est donné plus haut en sous-titre.

Le capital fut reparti en cent actions de $100 chacune. M. Pritchard en était le gérant-administrateur.

Les profits qu'on espérait retirer de cette entreprise reposaient sur une hypothèse. Les actionnaires avaient calculé qu'ils n'auraient qu'à faire un appel chaleureux aux chasseurs pour en obtenir gratis tout le poil dont ils avaient besoin.

Ils ne tardèrent pas à se désillusionner. Personne ne fut d'humeur à faire des largesses à la compagnie et elle dût payer pour se procurer cette matière première.

Le but de cette entreprise était de remplacer les étoffes en laine importées d'Angleterre par des tissus en poil de buffalo.

L'élevage des moutons était peu profitable à cette époque, à cause du grand nombre de loups. De plus, la compagnie projetait d'établir une tannerie pour préparer le cuir.

De cette façon, chaque peau devait produire un double rendement. Les actions furent placées facilement et en peu de temps tout le capital fut souscrit. Aussitôt, le prix des peaux de buffalo, subit une hausse considérable, qui désappointa grandement les promoteurs. Les chasseurs exigèrent $1.25 pour le cuir et trente-cinq centins la livre pour le poil.

Tout l'outillage de cet établissement fut importé d'Angleterre. On engagea à des salaires très élevés, des ouvriers d'expérience, dirigés par un surintendant, un secrétaire et un commis.

Avec de telles dépenses, il eut fallu manufacturer une grande quantité d'étoffes et avoir à proximité un marché pour les écouler. On plaça quelques pièces sur le marché anglais. Elles ne purent rapporter la moitié du coût de production.

L'entreprise languit et fut définitivement abandonnée en 1825. Après avoir épuisé son capital, la compagnie se trouva avec un déficit de $22,500. Cette somme était dûe à la compagnie de la Baie d'Hudson, qui se montra généreuse et en fit remise aux malheureux actionnaires. On prétend que ces étoffes quoique moins fines et plus grossières que celles d'Angleterre, l'emportaient de beaucoup quant à la durée et à la chaleur.

Première Ferme Modèle.

En 1823 la compagnie de la Baie d'Hudson établit à grands frais, à la pointe Douglas, une ferme modèle dont elle confia l'administration à W. Laidlaw. Elle construisit des maisons, granges, étables etc. Les dépenses au bout d'un an s'élevaient à 2000 louis. On comprit bientôt que le pays n'était pas mûr pour un tel projet et l'entreprise tomba à l'eau.

Culture du lin.

Lord Selkirk en 1811 avait fait des avances considérables aux colons. Quelques-uns lui devaient jusqu'à $1500.

En 1830 les héritiers de la succession Selkirk s'adressèrent à ces débiteurs retardataires pour en obtenir paiement. Après les désastres nombreux qui étaient venus fondre sur la colonie, ces braves gens ne se trouvaient pas en état de solder leur dette.

D'ailleurs il n'y avait pas de marché dans la colonie, ni de moyen pratique d'exporter les produits de la ferme.

Les colons commençèrent à se plaindre à la compagnie qui les abandonnait ainsi à leurs seules ressources.

Pour les encourager, la compagnie leur conseilla de semer du lin, et du chanvre. Cette tentative n'eut aucun succès.

Les cultivateurs ne savaient pas comment traiter le lin et lui faire subir les diverses opérations voulues pour en faire de la toile. De plus, on ne possédait dans le pays ni métier ni rouet. L'entreprise fut abandonnée.

Importation et élevage des moutons.

En 1834 Simpson crut le moment favorable pour introduire l'élevage des moutons dans le pays. On est étonné qu'un homme intelligent comme lui n'ait pas songé un instant à l'impossibilité de ce projet à cause des loups qui infestaient la prairie.

Une société fut organisée avec un capital de $6000. Un commis de la compagnie du nom de Rae fut chargé d'aller chercher un troupeau dans le Kentucky. On lui avait adjoint M. Bourque. Rae était un jeune homme présomptueux et sans expérience. Il refusa de suivre les sages conseils de Bourque et acheta 1475 moutons dans le Kentucky à des prix variant de 5 à 7 chelins par tête. Le Kentucky n'est pas précisément à la porte de Winnipeg. Craignant d'arriver trop tard à la Rivière Rouge, Rae mena le troupeau grand train, sans lui donner le temps de prendre haleine et de se remettre. Les moutons ne purent résister à la fatigue d'un voyage aussi long et tombèrent le long de la route. Quand il atteignit le fort Garry, il n'avait plus que 250 têtes. La compagnie de la Baie d'Hudson les acheta et les actionnaires en furent quittes pour payer leurs parts.

2ème Ferme Modèle.

La compagnie ne se découragea pas de ces entreprises infructueuses et en 1837 elle essaya de nouveau d'organiser une ferme modèle. Elle en confia le soin au capitaine Cary qui fit ensemencer cent acres sur la rive nord de l'Assiniboine.

Il commit la même faute que ses prédécesseurs et voulut faire grand comme en Angleterre, sans tenir compte de la différence des conditions. Il importa d'Angleterre des chevaux, des bêtes à corne et des instruments d'agriculture.

La ferme sembla prospérer tout d'abord, mais on constata plus tard que les recettes ne pouvaient suffire à solder les dépenses.

Cary se retira de la compagnie en 1847 et l'inondation de 1852 détruisit toutes les bâtisses. Ce fut la fin de l'entreprise.

La Compagnie de laine de L'Assiniboine.

Quelques années plus tard, les colons décidèrent de fabriquer des étoffes avec la laine des moutons devenus nombreux dans les voisinages de la Rivière Rouge. Tout alla bien pour commencer. On souscrivit avec enthousiasme une somme trois fois plus élevée que tout le numéraire en circulation dans la colonie, qui suivant l'historien Ross s'élevait à $9,500; mais quand il fut question de payer, le zèle se refroidit. Chacun demanda à réfléchir un peu avant de s'engager plus loin. La déconfiture de la première manufacture fut le sujet de leur examen. Bref, comme tout ce qui part trop vite, l'affaire n'alla pas loin. Ces projets si louables qu'ils fussent devançaient les temps.

La compagnie de suif.

Les mots de progrès et d'associations industrielles avaient été lancés et l'idée avait fait du chemin. Les esprits dirigeants espéraient trouver une exploitation qui pourrait se soutenir et verser des capitaux dans la colonie. Simpson qui appuyait chaleureusement tous les efforts de ce genre, se mit à la tête d'une nouvelle organisation, bien résolu cette fois à faire l'impossible pour la mener à bonne fin. Il choisit le suif comme objet d'exportation, afin de pouvoir du même coup favoriser l'élevage des bestiaux. Une compagnie fut donc constituée en 1832 avec un capital divisé en 200 actions de $50 chaque.

L'administration des affaires fut confiée à un bureau de directeurs. Les parts pouvaient se payer en nature si on le voulait.

Les actionnaires optèrent pour la plupart de payer de cette façon. La conséquence fut que la compagnie se trouva bientôt en possession d'un troupeau de 473 têtes de bétail. La première assemblée fut tenue dans l'ancien fort Gibraltar le 1er avril 1832. Simpson y porta la parole et encouragea les associés à aider au succès de la compagnie.

Malheureusement quelques jours après elle subit de sérieuses pertes. Le 30 avril, un vent violent s'éleva tout à coup et souleva une tempête. Il tomba 18 pouces de neige. On n'avait pas prévu un contretemps aussi insolite.

Les animaux furent réduits à se nourrir de bourgeons et de branche. Les plus faibles ne purent résister et 26 têtes furent perdues. Pendant l'été le troupeau augmenta considérablement.

La compagnie construisit près de la rivière La Seine à Lorette, à un endroit qu'on appelle encore "compagnie de Graisse", une grande remise sans toit, pour protéger les animaux pendant l'hiver contre le froid et les loups. L'hiver de 1833 fut très rigoureux et la neige abondante. Les animaux ne purent que difficilement brouter la prêle des prairies. Les serviteurs de la compagnie n'avaient coupé qu'un voyage de foin pour chaque animal. Cette provision fut épuisée avant le printemps. Comme conséquence 32 têtes moururent de misère et 53 furent dévorées par les loups. Les actionnaires découragés demandèrent la liquidation. A l'automne de 1834 le reste du troupeau fut vendu à l'enchère. Cette vente permit aux actionnaires de rentrer dans leur mise de fonds mais sans intérêt.

Moulin à vent.

La vapeur et l'electricité constituent de nos jours la puissance motrice par excellence. On ne trouve guère de moulin qui dépende du caprice des vents pour fonctionner. Autrefois c'était bien différent.

Bateaux et moulins tendaient leurs ailes aux vents et soupiraient après la brise pour marcher. Il en fut ainsi dans la colonie. En 1815 lord Selkirk expédia d'Angleterre les premières machines destinées à moudre le grain. Les rouleaux et les meules arrivèrent avec le premier contigent d'émigrants; mais on eut beau chercher, on ne trouva personne au pays qui put les mettre en place.

Ne pouvant en tirer profit, la compagnie les renvoya en Angleterre. Elles étaient destinées à se promener. Elles furent renvoyées de nouveau à la Rivière Rouge, accompagnées cette fois d'un mécanicien du nom de Mitchell, qui n'eut pas de peine à les mettre en mouvement. Grâce à ces faux frais, le moulin avait couté $7,500. Peu de temps après, M. Logan l'acheta et donna entière satisfaction aux colons.

Ross prétend que c'était le seul moulin à farine du pays, tandis que Gunn parle d'un moulin à vent construit en 1813 sur la rivière au Cygne par la compagnie du Nord-Ouest.

Pouvoir d'eau.

Cuthbert Grant fut le premier à construire un moulin mû par eau. Comme chasseur et chef d'expédition, Grant était un homme supérieur, mais comme industriel, il ne fit pas merveille. Il construisit une chaussée sur la petite rivière Eturgeon à six milles à l'ouest du fort Garry. Autrefois à son embouchure dans la rivière Assiniboine les pêcheurs prenaient force éturgeons. Aujourd'hui, où n'y voit plus ni poisson ni rivière. Ce n'est plus qu'un ravin au

fond duquel coule un mince filet d'eau qu'alimentent quelques sources. Il bâtit ensuite un moulin et un hangar pour recevoir le grain et se mit à moudre. Le moulin ne donna pas satisfaction au public, ni la chaussée à son propriétaire. L'eau commença par démolir l'une, mina l'autre et finalement les emporta tous deux. Après trois ans de dépense, il abandonna le tout à la dérive avec $4000 en moins à son actif.

Moulin à fouler et carder.

L'industrie lainière n'avait apporté que de sérieuses pertes à ses promoteurs. Le projet n'avait rien d'alléchant après ces insuccès répétés. Quelques colons hardis se jetèrent néanmoins dans la même entreprise quelques années après l'organisation du conseil d'Assiniboia. Ils bâtirent un moulin destiné à fouler la laine. Des capitalistes américains offrirent de le mettre en opération moyennant $250. C'était bien peu. Les colons mal avisés préférèrent s'adresser en Angleterre. Le coût des machines s'éleva à $1500. Une fois placées, elles refusèrent de fonctionner. Il fallut les réparer avant de s'en servir. Quand le moulin fut prêt, un cultivateur apporta 25 verges d'étoffe. Le foulon refusa de se mettre à l'œuvre pour moins de 100 verges et attendit un second envoi.

Un mois après, il reçut 30 verges, mais pendant l'intervalle, le premier cultivateur las d'attendre, était venu chercher son étoffe.

Le moulin ne put jamais fonctionner faute de matériaux. Vers 1845, Louis Riel père bâtit un moulin à carder, sur la rivière La Seine. Il fonctionna quelque temps et se ferma comme le précédent, faute d'encouragement.

Tisserands—Animaux domestiques.

Ce fut Sir George Simpson qui amena dans l'ouest les deux premiers tisserands, ou pour être plus exacte, les premières tisserandes, madame Lapolice et mademoiselle Ursule Grenier.

La compagnie se chargea de les payer pendant 3 ans à la condition que la mission catholique les logerait et les nourrirait. Elles arrivèrent en 1837. Une bâtisse fut construite pour servir d'école industrielle dans le pays et confiée à ces deux personnes. Cette construction fut détruite par les flammes l'année suivante au mois de mars et ne fut pas rebâtie. Mademoiselle Grenier se retira à l'évêché. Lord Selkirk avait fait passer dans sa colonie naissante, par la route de la Baie, un nombre assez considérable de chevaux et de vaches. Leur nombre s'accrut bientôt mais ils furent presque tous détruits pendant les troubles entre les deux compagnies rivales.

Les premiers porcs au pays furent importés en 1818 et venaient d'Angleterre. Les poules furent apportées du Sault Ste. Marie et de la Prairie du Chien.

Après l'union des deux compagnies, les colons se procurèrent des troupeaux de vache du Missouri en 1825.

Récensement de la colonie d'Assiniboia et des territoires du Nord-Ouest.

Années	Mariages	Maisons	Chef de familles catholiques	Population totale	Terres cultivées No. d'acres
1831	412	342	215	2140	1880
1834	505	490	257	2841	2576
1835	535	467	269	2999	2862
1838	566	501	301	3148	3016
1840	589	519	303	3588	3521
1843	589	528	288	3681	4196
1846	653	543	309	3498	4820
1849	1052	745	513	5391	6392

La population s'élevait en 1853 à 5391 âmes. On comptait 4 églises ou chapelles catholiques et 3 églises protestantes, un collège catholique fondé en 1820 et un couvent depuis 1844.

En 1857 le chiffre de la population était de 8000 âmes dont un peu plus de la moitié était métisse. Il y avait 8000 acres en culture. Les affaires de la compagnie étaient dirigées par un gouverneur, 16 facteurs en chef, ex-officio membres du Conseil, 29 traiteurs et 87 commis. Elle avait à son service 5 médecins 67 maîtres de poste, 1200 serviteurs permanents, 500 voyageurs et 150 officiers et matelots sur ses bateaux.

Pendant l'été, elle employait environ 3000 personnes. Le gouverneur Simpson qui avait sous ses ordres cette armée, se rendait presque tous les ans à la Rivière Rouge. Le voyage de Lachine au fort Garry se faisait en canot d'écorce et durait 45 jours. Les principaux guides furent Antoine Delaure, Beauchemin, Morin et deux Iroquois du nom de Dominique et de Nicolas.

Les chiffres suivants nous donnent une idée des profits retirés par la compagnie de ses comptoirs de traite. De 1840 à 1857 ils s'élevaient en moyenne à $327,565 par année. Les actionnaires recevaient comme dividences $200,000 et la balance des profits étaient repartie entre les facteurs et les traiteurs.

Demande d'annexion en 1857—York Boats—Choses et autres.

Comme nous l'avons déjà constaté, les colons en 1846 avaient demandé d'être annexés aux Etats-Unis, à cause des difficultés qu'ils appréhendaient entre ce pays et l'Angleterre au sujet de la délimination de la frontière de l'Orégon.

En 1857 un mouvement du même genre eut lieu à la Rivière Rouge. Cette fois, il était plus sérieux. La requête demandant l'annexion portait la signature de 600 colons. Elle fut transmise au ministre des colonies par M. McBeth. Bien entendu, elle alla mourir dans les tiroirs aux oubliettes.

La compagnie faisait transporter ses marchandises et ses fourrures à bord des fameux *York boats.*

Ces bateaux contenaient 100 pièces, soit 8000 livres en tout. Jusqu'en 1874 ils constituaient le principal moyen de communication. Chaque district avait sa brigade et chaque brigade comprenait 8 à 12 bateaux montés par huit hommes. Norway House vit jusqu'à 80 de ces bateaux à ses portes. La compagnie était obligée d'attendre plusieurs années avant de convertir en argent le produit des marchandises qu'elle expédiait à la Baie tous les ans. Le gouverneur Simpson calculait que pour les marchandises expédiées à la rivière McKenzie, il s'écoulait sept ans entre le jour qu'elles quittaient les ports d'Angleterre et celui où les fourrures étaient vendues sur le marché de Londres. La valeur des effets qu'elle expédiait annuellement pour les fins de la traite était en moyenne de $300,000.

La compagnie refusait de faire dès avances aux Sauvages et aux Métis qui ne lui vendaient pas toutes leurs fourrures. Or les Sauvages toujours imprévoyants avaient besoin à chaque automne qu'on leur fasse crédit jusqu'au printemps. Ils vivaient ainsi sous la quasi-dépendance de la compagnie. Cette dernière défendait d'importer des Etats-Unis pour audelà de $250 en valeur et cela une fois par an seulement. Malgré ce règlement, on constate qu'en 1851 déjà plus de 200 charettes allaient tous les ans chercher des marchandises à Saint-Paul. La compagnie n'envoyait d'Angleterre que 2 à 3 bateaux par année à la Baie et ils suffisaient à peine à transporter les effets de la compagnie. Faute d'espace dans ces bateaux, les colons ne pouvaient expédier en Angleterre ni les langues de buffle, ni les pelleteries soyeuses qu'ils s'étaient procurées pendant l'hiver. Dans ces circonstances, il n'y a rien d'étonnant si les colons tournèrent leurs regards vers Saint-Paul pour leur marché.

Les terres de la Rivière Rouge ou de l'Assiniboine dans le voisinage du fort Garry étaient vendues par la compagnie au prix de

$1.25 à $2 par acre. Jusqu'en 1857 les récettes provenant de ce chef ne s'élevaient qu'à $15,000. Les Métis ou vieux serviteurs prenaient la terre qui leur plaisaient davantage se fixaient dessus et ne payaient rien. La compagnie prenait note de cette prise de possession dans ses registres mais n'accordait pas de titre aux colons de ce genre. Lorsqu'un employé se retirait de la compagnie, cette dernière lui faisait don en général de 50 acres.

La vaccination fut introduite dans l'ouest pour la première fois, parmi les Sauvages en 1818. En 1835 des traiteurs de chevaux qui s'étaient rendus sur le Missouri furent atteints de la petite vérole et la répandirent à leur retour sur les bords de la Saskatchewan. La maladie fit bientôt de terribles ravages parmi les Sauvages. La compagnie fit vacciner plusieurs tribus et parvint ainsi à arrêter les progrès de ce terrible fléau. Enfin la compagnie s'occupa à faire des ponts sur les rivières et rendre passable les principaux chemins de la colonie. Elle consacrait annuellement à cette fin une somme variant de $3000 à $3500.

Les anciennes routes de l'Ouest.

Le premier blanc qui visita le lac La Pluie fut M. de Noyon vers 1688. Il remonta la rivière Kaministiquia et se rendit au lac Nemeukan et de là, au lac La Pluie.

LaVérendrye et ses successeurs ouvrirent une voie nouvelle par la rivière Pigeon. Ce fut la route suivie par tous les traiteurs jusqu'en 1797. Des arpenteurs et astronomes nommés pour fixer la frontière entre le Canada et les Etats-Unis reconnurent que le lit de la rivière Pigeon séparait les deux pays. La compagnie qui avait construit plusieurs bâtisses sur la rive sud de la rivière Pigeon résolut d'abandonner ses quartiers généraux, au Grand-Portage, et d'ériger un nouvel établissement à l'embouchure de la rivière Kaministiquia. Cette année-là, R. McKenzie revenait du lac Athabasca. Il était en quête d'un chemin qui put le conduire à la rivière Kaministiquia sans passer par la rivière Pigeon.

Un vieux Sauvage s'offrit de lui indiquer la première route suivie par les Français. McKenzie accepta avec empressement et atteignit sans accident la rivière Kaministiquia. Il donna à ce chemin le nom de "*Route du lac du Chien*", parce que le lac du Chien se trouvait sur cette voie.

Dès lors la route du lac du Chien fut adoptée par tous les voyageurs de l'ouest. En 1857, M. Dawson fut chargé par le gouvernement canadien d'explorer l'ouest. Il visita le pays depuis le fort William jusqu'à la Saskatchewan.

En 1869, le gouvernement profitant des connaissances de Dawson lui confia le soin d'ouvrir une route plus courte jusqu'au fort Garry. Il construisit un chemin de fort William au lac Shebandowan et suivit ensuite l'ancienne route jusqu'à l'angle du Nord-Ouest.

De là, il traversa la forêt jusqu'à Sainte-Anne. Cette route fut connue depuis sous le nom de "Chemin Dawson".

En 1846 quelques voyageurs se rendirent à la Rivière Rouge à travers la prairie depuis L'Aile de Corbeau jusqu'au fort Garry. Ce chemin se trouvait sur la rive est de la Rivière Rouge, qu'elle longeait jusqu'à Pembina. Plus tard on franchit cette distance sur la rive ouest, jusqu'à Breckenridge. Enfin quelques années après, on se rendit de Saint-Paul jusqu'au fort Abercrombie en diligence. De là, on prenait un bateau qui descendait la Rivière Rouge jusqu'au fort Garry.

La route des canots fut suivie par les missionnaires jusqu'en 1845. Mgr. Taché fut le dernier à pénétrer dans l'ouest par cette route si pénible et si dangereuse.

Sur le parcours de cette chaîne de lacs, rivières et portages, s'élevaient çà et là des croix qui protégaient les restes de voyageurs qui avaient péri, victimes de quelqu'accident.

Voici l'itinéraire de ce voyage:

Lachine, Lac des Deux Montagnes, Rivière à la Grèce, Les Ecores, Pointe Fortune, Canal du Long-Sault, Chute à Blondeau, Ile Roussin, Ile de la Chaudière, By-Town, lac des Chaudières, Portage des Chênes, Pointe au Sable, Portage des Chats, lac des Chats, Les Chevaux, Portage Dufort, Portage de la Montagne, et des Dargis, Grand Calumet, Fort Coulonge, Culbute des Allumettes, Fort des Allumettes, Pointe au Baptême, Portage des Joachim, Rivière Creuse, Roche Capitaine, Rivière des Cyprès, Portage des Deux Rivières, Décharge du Trou, Portage de l'Eveillé, Mattawan, Portage du Plain Chant, Décharge des Roses, de Campion, des Grosses Roches, des épingles, Portage du Paresseux, Décharge de la Prairie, de la Cave, Rapide des Perches, Hauteur des Terres, Portage du Talon, des Musiques, Pin de Musique, Détroit de la Tortue, Grand Portage des Vases, Milieu des Vases, Dernier des Vases, Rivière des Vases, Rivière et lac Nipissing, Pointe aux Croix, Rivière des Français, Chaudière des Français, Décharge des Pins, des Faucilles et des Parisiens, Culbute du Récollet, Lac du Bœuf, Lac Huron, Pointe des Grondines, Iles aux Renards, le Détroit, Fort Dubois, Détroit de la Cloche, Ile aux Serpents, Mississoguay, Pointe à Tessalon, Campement d'Ours, Grand et Petit Nibiche, Sault-Ste. Marie, Lac Supérieur, Pointe au Pin, Gros Cap, Ile aux Erables, Pointe à la Corbeille, Baie de Batchigwanang, Détroit des Mammens, Rivière de Montréal, Rivière des Rapides, Rivière

du Vieux fort, Gargentua, Campement Bouvier, Michipicoton, Rivière à la Chienne, Tête à la Loutre, L'Anse à la Pêche, Pic, Rivières au Rideau, aux Gravoirs, aux Sables, Blanche, du Pic, l'Anse à la Bouteille, Petites Ecores, Pointe à la Gourgane, Montagne du Tonnerre Baie Noire, Ile de Travers, Fort William, La Petite Prairie, Grand Rapide, Portage du Paresseux, Grandes Prairies, Pointe Meuron, Portage de la Montagne, L'Ecarté, Décharge des Roses, du Grand Rapide, Portage de L'Ile, du Racoursi, des Couteaux et des Cèdres, Décharges des Epinettes, de Bélanger, des Trembles, de la Droite, de l'Equerre, du Chien et du Diable, lac et rivières des Chiens, Portage de Jourdain, Rivière et lac de la Quenouille, lac Froid, *Portage de la Prairie* qui est à la hauteur des terres, lac Rond, de la Prairie, Portage du milieu, lac, portage et rivière de la Savanne, Mille lacs, Portages du Baril, de la Pente, des Français, lac du Poisson Doré, rivière des Français, lac des Poissons Dorés, Portages des deux Rivières, du Grand Calumet, petit portage de la Pente, des Epingles, Culbute du Petit Rocher, Portage de l'Ile, lac Lacroix, Portage La Croix, Lac Nemeukan, Portages Neufs, Lac et rivière La Pluie, Fort du lac La Pluie, La Petite et la Grande Fourche, Rapide Marabou, Ile au Sable, (lac des Bois), Rocher Rouge, Pointe aux Gravoirs, Pointe au Chêne, Portage du Rat, Rivière Winnipeg, La Grande Equerre, les Dalles, Grand Galais, Décharge de la Terre Jaune, Portage du Rocher, La décharge de la Terre Blanche et celle de la Cuve, Portage de l'Ile, La Pointe, Chute à Jaquot, Pointe de Bois, Petit Rocher Brulé, Portage de la Chute des Esclaves, La Barrière, Décharge du Grand Rapide, des petites Faucilles, Rivière Blanche, les Eaux qui remuent, Petit Rocher du Bonnet, Grand Portage du Bonnet, le Galais du Bonnet, lac du Bonnet, La décharge à Minet, Bas de la Rivière, lac Winnipeg et Rivière Rouge. Le trajet en tout comprenait 2118 milles.

Itinéraire des missionnaires et des voyageurs de Fort Garry à l'Ile à la Crosse, à bord des berges de la brigade du Portage La Loche.

Fort Garry, lac Winnipeg, Norway House, Grand Rapide, Rivière Saskatchewan, lacs Cumberland, Eturgeon, Castor, Rivière Verte, lacs Héron, Pélican, des Bois, Portage de la Grenouille, Fort à la Traite, rivière Churchill, lacs Genou, Primeau, Ile à la Crosse, Rivière à la Crosse, lacs Buffalo, Methy, rivière Eau Claire, Portage la Loche. C'est au milieu de ce Portage que la brigade du Portage la Loche rencontrait la brigade du Nord chargée des pelleteries du fleuve McKenzie et du lac Athabasca et du grand lac des Esclaves. Après avoir remis à la brigade du nord les marchandises de traite et reçu

en échange les fourrures du Nord, la brigade du Portage la Loche revenait sur ses pas jusqu'à Norway House, descendait la rivière Nelson, atteignait le fort Nelson et revenait au fort Garry après avoir parcouru 4000 milles.

Routes des Missionnaires du Nord.

C'est par le lac Winnipeg et la rivière Saskatchewan que les missionnaires, tout comme les compagnies de traite, pénétrèrent dans l'intérieur de l'ouest et plus tard jusqu'au pôle Nord. Durant l'été de 1856 le P. Maisonneuve O.M.I. qui se trouvait au lac La Biche se rendit en charette, de ce lac jusqu'au fort Pitt sur la Saskatchewan. Ce voyage à cette époque constituait un événement. Les forêts qui séparent le lac La Biche de la région des prairies rendait cette route peu commode. Toutefois en 1870, la compagnie ayant signifié à Mgr. Faraud, que ses berges ne pouvaient plus à l'avenir se charger des transports des effets des missionnaires, la route ouverte en 1856 fut utilisée. C'est par cette voie que les missionnaires firent transporter leurs marchandises sur la rivière Athabasca, jusqu'à la construction du Pacifique Canadien.

En 1879 le chemin de fer de Saint-Paul-Minneapolis atteignit Saint-Boniface et demeura jusqu'en 1880 le nec plus ultra des voies ferrées du pays.

Le Pacifique Canadien ne tarda pas à traverser la Rivière Rouge et à couvrir tout l'ouest de ses embranchements qui apportèrent avec eux, le progrès et la prospérité.

Saint-Boniface, mars 1913.

Transactions of The Royal Society of Canada
SECTION II

SERIES III SEPTEMBER 1914 VOL. VIII

Sketches of the Islands of the Gulf of Georgia.

By CLIVE PHILLIPS-WOLLEY.

(Read May 26, 1914.)

SPRING IN HIDING.

Are you hiding from us Springtime, hiding in the slashing?
Coming from the mountain, I saw your tracks go down
In among the willow swamps, I heard your young feet splashing,
Saw—among the alder stems—the glitter of your gown:

Found—upon a snow drift—toys you dropped in running,
Cups of pale anemone, full of fairy fire:
On the mossy benches, where the deer were sunning,
Almost caught a glimpse of you, clad in green attire:

All but caught you peeping; caught the corner lifted
Of that dainty veil you weave, of cedar lace and mist;
The shadow of your flying robe across the plough land drifted,
The ridges blushed to purple which your little feet had kist.

The catkin told your secret. He was bursting, dear, to tell it,
And the dimpled baby brooklet just chuckled it aloud,
All the fog grew opal tinted and a miracle befel it—
Was it just a common rainbow, or your smile behind the cloud?

Ah, then, won't you come, coquette? Must we weary for you yet?
Won't you teach the world a quickstep, put a rose behind its ear?
Won't you sing us all the silly songs that coax us to forget
Sow a hope in every bosom and a rainbow in each tear?

The Mortgaged Farm.

The orchards have come to bearing—In billows of rosy bloom
Nestles the Settlers homestead—The fringes of gorse and broom
Glow golden against the sapphire—The meadows that seaward sweep,
Tuneful with bells and drowsy with bleatings of full fed sheep,
Are sweet with the clover's incense—Roses climb to the eaves—
Drunken with sweets, the sea winds sleep in the maple leaves.

And you have bought up the mortgage? Man, but that was not dear!
A dollar we'll say per acre, and twenty for every year
It took those two to clear it. That matters but little now,
She has the peace she prayed for, and he has rest from the plough.
And you? Being free from a mortgage, you'll make the old farm pay
Managed by modern methods, worked in a business way.

Let us go back to the slashing where you heard the pheasant crow,
Where under the fallen giants the dog-tooth-violets grow,
Deers-foot and ladies slippers, the only flowers which grew
To deck my lady's parlour when that old house was new:
When he was digging "borders," and she, with mother's care,
Tending her "slips" from England, the planting of each a prayer
For a home like that home she came from—There is the fight he won:
Here is the field he died on, the work that he left half done.

Can you not see them bending over the crosscut saw,
Love their only possession, labour their daily law:
The Douglas leaning slowly, its topmost limbs asway
To rush to earth a ruin, in clouds of woodland spray—
See them, close together, their own lives on the wane,
Counting the years her roses will take to her window pane,
See the dreams that they lived for, the pictures fancy drew
Of fields they never finished, of folds they never knew.

Aye, you have bought a bargain with human lives thrown in,
Their fields to bear the harvests your reaper folk shall win,
But *the dream* which those folk fashioned has not been bought or sold.
When Spring is most impassioned, when gorse is virgin gold,
When grass is living emerald and evening seas afire,
When pines are full of music as youth with love's desire,
You shall feel an unseen presence, shall hear a heart in tune
With the glory of *her* roses, with the peace of early June—
You shall balance fact with fiction, their dream against your dross
The profits of your purchase, the requitals for their loss.

Autumn Salmon Run.

Vague space, and in the hush, Dawn's pencil drew
On the damp clouds of darkness, line by line
Peaks and vast headlands, while a fresh wind blew
Sharp with the stinging kisses of the brine
Pungent with perfume of the sun-burnt pine—

Through drifting veils of filmy forest smoke
Filtered the rose-pink promise of the day
The sea plains heaved, the tide rip laughing woke—
Beyond the sun limned shallows of the bay
Ocean, a palpitating opal, lay—

Misty, mysterious. Throbbing fairy fire
Coursed through its veins and all the madcap throng
Which cradles in the tide rip, Ocean's choir
In stoles of roughened silver, deep voiced, strong,
Danced as it sang the young tide's meeting song—

Working the sea to madness. Sudden waves
Roared by the cliffs, fretted the canopies
Written with runes, and echoed in the caves.
There was no wind to swing the slender trees,
And yet, through fields of calm, ran racing seas.

Strange eddies came and went—The black toothed rocks
Were whelmed in waters piled upon an heap—
Louder and wilder grew the thunder shocks
Of the tempestuous rip. Beyond—the Deep
Lay calm and smiling, mother-like asleep.

Then fell a miracle. The waters knew
Some deep sea call, and their swift tides became
Incarnate, and sudden incarnate grew
Their shifting lights—Argent and azure flame
Drave through the deep. The salmon pilgrims came.

A pilgrimage foredoomed, from depths profound
To grey Alaskan waters, turgid, pent
Mid mildewed pines, where never sun nor sound
Of ocean's song can reach—The last event,
To rot on glacial mud, frayed, leprous, spent.

Note.—The salmon pass East Point on Saturnia Island in the early autumn season of forest fires, on their way to grim Alaskan waters, where most (all ?) of them die.

Canada's Emblem.

When the white frost lies on the topmost rail
    Which fences the fold where the sheep are fed,
When the stems of the purple fire-weed fail,
    And the bracken losing its russet red
    Takes the livid hue of the clouds o'er head,
When the fear of the Ghost from the White North grows
    In sullen pines where the wolves are bred;
In Gold and in Crimson the maple glows—

When under the stars on an unseen trail,
    The hosts of the clamorous fowl have sped,
When the old folk die and the young folk ail,
    And the homing cattle by instinct led
    Come wandering down to the ranchers stead,
When the old year draws to a dreary close
    And the hearts of men are oppressed by dread;
In Gold and in Crimson the maple glows—

When the rain storms thresh with pitiless flail
    The last faint flowers in the garden bed,
And the sloops drive home under shortened sail,
    When the songs are over and song birds fled,
    And the last farewell of the Autumn said,
When the bleak world shudders because it knows
    That the feet of its dying are round its dead;
In Gold and in Crimson the maple glows—

L'Envoi.

Even so should a brave man's sunset shed
    From the heights of pain, through the mist of woes,
A flame on the path which we all must tread.
    In Gold and in Crimson the maple glows.

A Sou' West Storm.

From the brooding gloom of the wild Sou West
The scuttering black duck come,
While the wheeling mallards drop in to rest
In the whisp'ring sedge where they had their nest,
And our loosened shingles hum.

There's a threat in the tops of the swaying trees,
And the sea's skin seems to crawl,
The sheep and the cattle are ill at ease,
A blind swell travels before the breeze
And tosses my anchored yawl.

Oh, heavy the drops on the barn roof ring,
Stars spatter on ev'ry pane,
Across the mist goes a found'ring wing
Blown out of the sky—The salt sprays sting
And the lights begin to wane.

On the sodden pastures the splashes spread,
Wide stretches of cheerless gray;
In the hollow tree the coon is a'bed,
The murdering mink to his cave has fled,
And the fish have fled the bay.

Then the wind that is wet with an old world's tears,
That mourns for millions dead,
Grown mad with the woe of a thousand years,
Burdened with prayers that no kind God hears,
Shrieks like a soul in its dread.

All Life cowers dumb while the dead trees cry,
The long dead kings who have stood
Through countless years with their crowns in the sky,
They totter and fall and the wind sweeps by
And Hell is loose in the wood.

But the trees may crash and the house walls throb
And the loosened shingles hum;
The Heavens may rave, and the wet winds sob,
For faith has a cache that no winds may rob—
She knows that Spring will come.

Christmas Greeting.

Back! we are back from the frontier lands,
Where the greatest game of the world is played,
Where men take their lives in their reckless hands,
Play hazard with Death and are undismayed.
We are back from the mine and the railway grade
To our island home mid the orchard trees,
Each to his merry Canadian maid—
Peace and goodwill to you over the seas.

We have seen the surf upon Arctic strands,
Have tickled Earth's ribs with a miner's spade.
Washed gold at Nome from the frozen sands
Where mammoth and aurochs lie undecayed;
Back in our overalls tattered and frayed
To kneel with our girls on our bended knees,
Praying the prayer that the angels prayed—
Peace and goodwill to you over the seas.

We have done the work which the Race demands,
Have worked for a wage which cannot be paid,
Contented, if only She understands
That 'twas not for a dole of fame or trade
Alone that we cleared, that the rails were laid,
But just for Her folk, whom such labour frees,
Giving room to breathe in the homes we made—
Peace and goodwill to you over the seas.

L'envoi.

Sire! if political critics upbraid,
As if we forsooth had not paid our fees
To share in the Empire our fathers swayed—
Point to the world you rule over the seas.

Highways of the Fur Trade.

By LAWRENCE J. BURPEE, F.R.S.C., F.R.G.S.

(Read May 27, 1914).

A glance at the map of the northern half of North America readily suggests why the routes of the fur trade were almost invariably water thoroughfares. Nowhere else in the world will one find such a remarkable system of waterways as that of North America, and particularly of the upper half of the continent. It is not merely theoretically possible to travel in a canoe across the continent, east and west, north and south, with an occasional portage, but the fact has been demonstrated over and over again by explorers and fur-traders. From Lake Winnipeg, in the heart of the continent, one may paddle east up Winnipeg river to the Lake of the Woods, thence by Rainy river, Rainy lake, and a series of smaller waterways over the almost imperceptible height of land and down to Lake Superior, coast along the shore of that inland sea, descend the St. Mary's river to Lake Huron, and from there either follow the Great Lakes down to the St. Lawrence, or take the old route by way of Georgian bay, French river, Lake Nipissing and the Ottawa to Montreal. From Lake Winnipeg, again, one may take either the Hayes route or the Nelson to Hudson bay. From the same central lake, one may ascend the Saskatchewan to the Rocky mountains and descend the Columbia to the Pacific; or, leaving the Saskatchewan at Cumberland lake, paddle through a series of small waterways to the Churchill, ascend that river to Lake La Loche, descend the Clearwater to the Athabaska, the latter to Lake Athabaska, ascend Peace river to one of its sources at the headwaters of the Parsnip, portage to the Fraser, and descend that wild stream to the ocean. Again, following the last route to Athabaska, one may descend Slave river to Great Slave lake, and follow the mighty Mackenzie to the Arctic. Finally, returning once more to Lake Winnipeg, one may ascend the Red river to its upper waters, portage to the Mississippi and descend the Father of Waters to the Gulf of Mexico. And these are but a few of many possible routes from Lake Winnipeg to the shores of the three oceans. The fur-traders did not need any gift of shrewdness to lead them to the adoption of water routes. Water routes were practically thrust upon them. Wherever they went they found some river flowing to or from the place they sought, and that river was generally the easiest and often the only road to follow.

In sketching very briefly the development of these thoroughfares of the fur trade, one finds two more or less definite and distinct starting-points. In the north, the men of the Hudson's Bay Company pushed their way inland from Hudson bay to Lake Winnipeg. From the St. Lawrence, the fur-traders of New France, and their legitimate successors of the North West Company, ascended the Great Lakes to the Kaministikwia or the Grand Portage, and from there they, too, made their way to Lake Winnipeg. From Lake Winnipeg, for a time independently, and later as factors and traders in the one surviving company, they worked their way west and north over far-flung thoroughfares, to the remote shores of the Pacific and the Arctic.

Of the earlier attempts of the pathfinders of the Hudson's Bay Company to penetrate the vast wilderness that lay to the west of Hudson bay, one, that of Samuel Hearne, had its starting point at Prince of Wales Fort, at the mouth of the Churchill river; another, that of Henry Kellsey, at Fort Nelson, at the mouth of Nelson river. Hearne's expedition, important though it was from a geographical point of view, need not be considered here as it opened up no route in to the interior. Kellsey's much earlier expedition, up the Nelson river and beyond, was equally unfruitful. There is evidence that both the Churchill and the Nelson were used to some slight extent by the fur-traders, and to a much greater extent by Indians bringing down their furs to the forts on the bay, but neither was ever developed into a trade route to the interior. The recognized road to the west was by way of the Hayes river, and the gateway was York Factory near the mouth of that river.

From York Factory set out two of the explorers of the Hudson's Bay Company who were instrumental in blazing a trail from the bay to the heart of the great plains—Anthony Hendry in 1754 and Matthew Cocking in 1772.[1] As far as Knee lake they followed what was afterward known as the Hayes route, but from Knee lake they turned over to the Nelson, through a country that remained unsurveyed almost to the present day. The rivers and lakes they traversed between Knee lake and Cross lake on the Nelson are not shown on any of the government maps. The first authentic account of the Hayes route proper, from York Factory to Playgreen lake and Lake Winnipeg, is contained in the journals of David Thompson, for some years an officer of the Hudson's Bay Company, and afterward astronomer of the North West Company. In 1787 Thompson went inland from York Factory to the Saskatchewan, by way of the Hayes Route and Lake Winnipeg. His description of the route will be

[1] For their journals, see Trans. Royal Society of Canada, 1907, and 1908.

found in McLeod's *Peace River*, p. 47.[1] A more interesting account is that of Captain (afterwards Sir John) Franklin, in his *Journey to the Polar Sea*, ch. 2.[2] The route was by no means an easy one, involving a number of portages, but it was preferable to the Nelson whose tempestuous current and rapids made navigation both difficult and dangerous. For a century and a half the Hayes has been the recognized thoroughfare from Hudson Bay to Lake Winnipeg.

Let us turn back now to the St. Lawrence and trace briefly the opening up of the southerly fur trade route from Montreal to Lake Winnipeg. During the French régime two water routes were recognized, and used to a greater or less extent, from Montreal to Lake Huron. One followed the Great Lakes by way of Niagara and Detroit; the other the Ottawa river, Lake Nipissing and French river to Georgian bay. Both led to the trading posts of Michilimackinac and Sault Ste. Marie, and thence around the wild shores of Lake Superior to the Kaministikwia and Grand Portage. So the present-day quarrel between Montreal and Toronto as to the respective merits or demerits of the Georgian Bay route and the Welland Canal route may perhaps be traced back to the seventeenth century. Broadly speaking, the Niagara route led to Detroit, to the Ohio, the Illinois country, and the Mississippi; while the Ottawa route was the great highway to the far west, although for a considerable period this was also the recognized route to the Illinois and the Mississippi. The use of the Ottawa route from Montreal to Georgian bay and Lake Huron dates from the expeditions of Le Caron and Champlain in 1615, from those of Etienne Brûlé in 1622, of Nicolet in 1634 and of Jogues in 1641. Around the shores of Lake Superior, the way was led by Ménard in 1661, Radisson about the same time, Allouez in 1665, and Dulhut in 1678. As to the Niagara route, its use may perhaps be traced back to Brûlé's discovery of Lake Ontario in 1615, and Brébeuf and Chaumonot's discovery of Lake Erie in 1640, or possibly Dallion's visit to the Neutral Nation in 1626. At any rate, by 1679 not merely canoes but La Salle's little ship the *Griffon* is navigating the waters of Lake Erie and Lake Huron; and in 1701 Cadillac is founding a trading post at Detroit.[3]

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[1] Peace River. A Canoe Voyage from Hudson's Bay to Pacific, by the late Sir George Simpson, in 1828. Edited with notes by Malcolm McLeod. Ottawa, 1872.

[2] Narrative of a Journey to the shores of the Polar Sea, in the years 1819–20–21–22. By John Franklin. London, 1823.

[3] See Lahontan's *New Voyages to North America* for an account of the route from Montreal to Niagara, and Sabrevois' Memoir of 1718 (Wis. Hist. Coll., xvi, 363), for an admirably detailed description of the route from Niagara to Detroit and the Illinois country. For the Ottawa route, in the early days, one cannot do better than refer to Benjamin Sulte's paper on "The Valley of the Grand River" (R.S.C. Trans., 1898).

One of the notable advantages of the Niagara route was its freedom from portages. With the exception of those around the St. Lawrence River rapids, and the somewhat formidable portage to surmount Niagara Falls, the way was clear from Montreal to Sault Ste. Marie; while the Ottawa route involved a succession of more or less troublesome portages between Montreal and Georgian bay. Champlain says: "In the Algonquin (Ottawa) river from Sault St. Louis to near the lake of the Bisserouis (Nipissing) there are more than 80 rapids great and small."[1] On the other hand, the latter route possessed two distinct advantages: it was shorter, and more sheltered.

This brings us to the western end of Lake Superior, between which and the Lake of the Woods four canoe routes were known and used to a greater or less extent. The first of these to be discovered was that by the way of the Kaministikwia river. In the year 1688 Jacques de Noyon, bent on discovery, made his way up that river to Dog lake and by Dog river to a small lake at the height of land, now known as Height of Land lake. From here he descended to Lac des Mille Lacs, and by the Seine river to Rainy lake, or the Lake of the Christinaux as it was then called. He wintered at the western end of this river. In the spring he descended the Ouchichig, or Rainy river, to the Lake of the Woods, or Lac aux Iles as it is called in the narrative.[2] In 1717 Zacharie Robutel de la Noüe seems to have followed the same route to Rainy lake, but proceeded no farther to the westward.[3]

In the year 1730, Pierre Gaultier de Varennes, Sieur de La Vérendrye, was stationed at Kaministikwia. The following year he began his long series of western explorations with a view to the discovery of a practicable route to the Western sea. His route from Lake Superior to Rainy lake, where the first of his trading posts was built, was by the way of Grand Portage.[4] La Vérendrye did not himself reach Rainy lake until the spring of 1732, the pioneer trip over the new route being made in the autumn of 1731 by his nephew, La Jemeraye. This journey would appear to mark the discovery of the afterward famous Grand Portage route. An earlier mention of the route is, however, found in a letter of 1722 by an officer named Pachot who, in urging the establishment of a post on Rainy lake says, "The best route to go to the proposed establishment would be by a small river named the Nantokouagane, which is about 7 leagues from

[1] Laverdière ed. p. 1391.

[2] Margry, Découvertes et établissements des Français, vi, 495 *et seq.*

[3] Margry, vi, 504 *et seq.*

[4] Journals of La Vérendyre (Dominion Archives MSS).

Kaministigoya."[1] This evidently refers to Pigeon river, and the Grand Portage route.

La Vérendrye in describing this route says that forty-seven portages have to be made in going from Lake Superior to Rainy lake, and he mentions another route farther north which involved only nine portages, and was believed to be more practicable. This northerly route proved on investigation to be unsatisfactory, as it added many leagues to the journey, and was so shallow that eight-seat canoes could not be taken through without great difficulty. He therefore returned to the Grand Portage route, employing his men in improving the navigation, reducing the portages to thirty-two, and clearing the portage paths so that seven could be made in a day. It is not certain if the more northerly route mentioned by La Vérendrye was that by the way of the Kaministikwia, or one of several variants of the Grand Portage route. As has been noted elsewhere, La Vérendrye makes no mention in any of his letters or memoirs of the explorations of De Noyon or La Noüe, and there is no reason to suppose that he had ever heard of them. "Indeed, in studying this period of western discovery, one is struck by the fact that each of the French explorers worked independently, without availing himself of the results of previous explorations, if indeed they had ever come to his knowledge."[2]

A third route from Lake Superior to Rainy lake and the Lake of the Woods was by way of the St. Louis river, at the extreme western end of the lake, where the city of Duluth now stands. This route was unknown, so far as we have any evidence, during the period of French rule, though portions of it may have been traversed by Dulhut[3] in the course of his explorations in the Sioux country 1678-1681, and possibly by Radisson and Chouart[4] in 1661. A century or more later (1767 to be exact) Jonathan Carver also used some of these waterways on his way from the Mississippi to Lake Superior.[5] In 1798 David Thompson, astronomer of the North West Company, made a rapid reconnaissance survey from the Assiniboine to the

[1] Margry, vi, 513 *et seq.*

[2] Burpee, "Canoe Routes from Lake Superior to the Westward," *Geographical Journal*, Aug., 1910, p. 200. Further details of the development of the Kaministikwia and Grand Portage routes will be found in the article quoted above. The first detailed description of the Grand Portage route is in Alexander Henry's "Travels and Adventures in Canada and the Indian Territories, 1760–1776," 1809. New ed., 1901.

[3] See his letters to Frontenac and de Seignelay, 1769 and 1685, in Dominion Archives, "Posts in the Western Country," Vol. 16. Also Minn. Hist. Coll. I, 314.

[4] See Radisson's Voyages, Prince Society, 1885, and Sulte's article, R.S.C. Trans. 1904.

[5] "Travels through the Interior Parts of North America," 1778.

sources of the Mississippi, thence to Lake Superior.[1] We know, however, from his own writings that the route from Lake Superior to the Lake of the Woods by way of the St. Louis river had been discovered by the traders of the North West Company some time before. In a letter dated 1840, on the boundaries between the United States and British North America,[2] he says:

"The inspection of the map will clearly show the superior communication by the River St. Louis (then, 1783, the great thoroughfare of the fur trade both to the interior, the Lake of the Woods, and to the rich countries of the Mississippi and its branches) to the Lake of the Woods, over all other communications; it is a continuous river to a height of land, thence by a carrying place of 6,278 yards to the Vermillion River, which descends into Lake Nameukan, and thence direct to the Lake of the Woods."

Another route, by way of the St. Louis river, over the height of land to the upper waters of the Mississippi, up that river to Leech lake and Red Cedar lake, and down the Big Fork to Rainy river, is described in George Henry Monk's "Some Account of the Department of Fond du Lac," 1807.[3]

According to David Thompson, the St. Louis river formed the principal route of the fur traders during the early years of British rule in Canada, and the Grand Portage route only came into general use as a result of disputes with the United States authorities as to boundaries, following the Treaty of Versailles in 1783. Similar difficulties some years later drove the traders still farther north. "In the summer of 1800," says Thompson,[4] "a United States collector landed (at Grand Portage) and told the British fur traders the bay and carrying place were within the United States territory, and he would levy duties on all the merchandise and furs that should be landed in the bay, or pass on the carrying place . . . . The British fur traders were aware that against the arbitrary duties to be levied they would have no support from the Provincial government of Canada; they were therefore obliged to explore and open out a very broken and circuitous route to the interior by the Kah-min-is-tikquoi-aw river, about forty miles north-eastward of the great carrying place of the Pigeon river, at great labor and expense, and in 1802 removed thereto."

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[1] See Coues' notes in his edition of the Henry-Thompson Journals, 1897, and Tyrrell, "Journeys of David Thompson," 1888.

[2] In Dominion Archives.

[3] Masson Papers, in the Archives of McGill University.

[4] *Op. cit*

The accidental rediscovery of the old Kaministikwia route is described in the Reminiscences of Roderick McKenzie,[1] of the North West Company:

"After a long absence in the Indian territories," he says, "I paid this year (1797) a visit to Canada. Returning the following Spring, on my first trip from Grand Portage to *Lac La Pluie*, I met a family of Indians at the height of land from whom I accidentally learned the existence of a water communication a little way behind and parallel to this, extending from Lake Superior to Lake *La Pluie*, which is navigable for large canoes and, if adopted, would avoid the Grand Portage. This was excellent information; of course I immediately engaged one of the Indians to meet me at a certain point in *Lac La Croix*, to show me this new route, but on my arrival, as appointed, the Indian was not there. However, being acquainted with the entrance of the route, I proceeded without him and reached a post of the company where I procured a guide who accompanied me to Caministiquia on Lake Superior, from whence I soon reached Grand Portage, being the first who reached there from *Lac La Pluie* direct by water communication."

This, however, was not the first attempt to discover a practicable canoe route for the North West Company north of Grand Portage. As mentioned by Roderick McKenzie in his Reminiscences, the company had as long before as 1784 sent an expedition to examine a water communication reported to exist between Lake Nipigon and the Winnipeg river. This expedition was in charge of Edouard Umfreville.[2] Umfreville made his way through to the mouth of English river, and reported the route practicable, but it was roundabout and inconvenient, and the fur-traders continued to use the Grand Portage until the end of the century, when they finally adopted the Kaministikwia route, and rebuilt near the mouth of the river their famous post Fort William.

From the Lake of the Woods to Lake Winnipeg, La Vérendrye had long since led the way down Winnipeg river. His Journals record the fact that he discovered another route between the two lakes, by way of Roseau river and the Red river, but this was not practicable except for light canoes, and Winnipeg river continued to be the highway of the fur trade not only in his day but for a hundred years or more thereafter.

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[1] Masson, *Bourgeois de la Compagnie du Nord-ouest*, I, 46.

[2] Umfreville's narrative is among the Masson Papers in the McGill University Archives. An account of the journey will be found in "Canoe Routes from Lake Superior to the Westward, *op. cit.* See also "Memorial of the North West Company," 1784, and letter of James McGill to Henry Hamilton, 1785, in Report on Canadian Archives, 1890, pp. 48 and 56.

From Lake Winnipeg, La Vérendrye and his sons, and their successors during the French régime, explored the Red and Assiniboine rivers on the one hand, and that mighty river of the plains, the Saskatchewan, on the other, though none of the three were actually traced to their headwaters until years after the close of the period of French rule in Canada. The sons of La Vérendrye were also instrumental in opening to white traders a route that apparently had long been used by the Indians, from the Saskatchewan to the Assiniboine by way of Lakes Winnipegosis and Manitoba. Portage la Prairie, near the site of La Vérendrye's trading post of Fort La Reine, marks the Assiniboine end of the route.

The headwaters of the North and South Saskatchewan led by Rocky Mountain passes to the upper waters of the Columbia and the Kootenay, and so to the Pacific; but long before the course of western exploration had been pushed so far, adventurous fur-traders had found a way to the vast system of waterways of the extreme north-west. First of these was an enterprising New Englander named Peter Pond who, in 1778, made his way from the Saskatchewan to the Churchill by way of Cumberland Lake and Frog Portage. Thus far he had been preceded by Thomas and Joseph Frobisher and Alexander Henry, and also up the Churchill to Ile à la Crosse lake, but beyond that point Pond was the original explorer. Crossing what was afterward known as Methye Portage, he looked down into the beautiful valley of the Clearwater—a scene made memorable by the travels of many famous explorers of later years, Alexander Mackenzie, Franklin, Back, Richardson and others. Descending the steep slope he found himself on the banks of a river whose waters ultimately find their way to the Arctic ocean. He followed the Clearwater to the Athabaska, and the latter to the lake of the same name. A year or two later he descended Slave river to Great Slave lake, which Samuel Hearne had discovered from the north in 1771, and also appears to have reached the waters of Peace river.[1]

Eleven years after Pond's discovery of Lake Athabaska, Alexander Mackenzie left Fort Chipewyan, the North West Company's trading post on that lake, for his memorable journey to the mouth of the river that bears his name. He descended Slave river to Great Slave lake, found the outlet of the Mackenzie, and after many adventures finally traced it to the Arctic ocean. Three years later this tireless explorer set forth again from Chipewyan, ascended the Peace through the Rocky Mountains, and after surmounting almost incredible difficulties found himself at last on the shores of the Pacific—

[1] A detailed account of Pond's explorations will be found in "The Search for the Western Sea," chap. vii.

having solved at last the problem that for a couple of centuries had baffled French explorers, an overland route to the Western sea.[1]

The fur-traders of the rival companies, the Hudson's Bay Company and the North West Company, now had available water routes from Hudson bay on the one side and Montreal on the other, to Lake Winnipeg, and by way of the Assiniboine and Saskatchewan to the heart of the great plains; by Frog and Methye portages to Lake Athabaska, the Peace River country, Great Slave lake, and the valley of the Mackenzie; and by the Peace River pass over the mountains to that new empire of the far west soon to be known as New Caledonia.

Following Mackenzie's expedition through the Peace River pass in 1793, and stimulated by his example, other adventurous spirits of the North West Company discovered and named various passes through the Rocky mountains south of the Peace. In 1800 Duncan McGillivray ascended the North Saskatchewan to a pass which he named after Jasper Howse, of the same company. In 1811 David Thompson ascended the Athabaska, and its tributary the Whirlpool, to the height of land, and discovered Athabaska pass—for many years afterward the principal thoroughfare east and west through the mountains. Yellowhead, or Tête Jaune, pass, seems to have been discovered about the same time. The Simpson and Kicking Horse passes were discovered many years later, the first by Sir George Simpson, and the latter by Dr. James Hector of the Palliser expedition.

It is a fact not without interest in the present rapid survey of water thoroughfares, that these and other passes through the Rocky mountains form the gateways leading to and from the river systems on either side the continental divide. As the writer has had occasion to say elsewhere:

"To reach any of the rivers that drain the Pacific slope it is necessary to cross one or other of the Rocky Mountain passes. Here the rivers of the plains were still the friends of explorers, as they had been in the easy access they afforded from one to another. Their guiding fingers pointed the way, and their waters offered a certain, if not always easy, pathway to the eastern entrance of every pass through the mountains. The Peace river leads not only up to, but through the Peace River pass; Pine river, a branch of the Peace, offers a passage-way through the pass of the same name, and connects with the Missinchinka, a small tributary of the Parsnip; the Miette, a mountain affluent of the Athabaska, rises near the summit of Yellowhead pass, close to the headwaters of the Fraser; Whirlpool river, another

[1] Voyages from Montreal through the Continent of North America to the Frozen and Pacific Oceans, in 1789 and 1793.

branch of the Athabaska, similarly rises in the Athabaska pass, and donw the western slope a small stream leads to the Columbia; a tributary of the North Saskatchewan rises in Howse pass, almost within a stone's throw of the source of the Blaeberry branch of the Columbia; similarly the Kicking Horse pass, Simpson pass, White Man's pass, Kananaskis pass, the North Fork, the Crows Nest, and the North and South Kootenay passes, are all approached by one or other of the numerous tributaries of the South Saskatchewan, and in every case on the other side of the summit a branch of either the Columbia or the Kootenay is ready to convey the traveller, or at least to lead him, to the main streams in the valleys below."[1]

Alexander Mackenzie discovered the upper waters of the Fraser river, in his expedition of 1793, but thought it was the Columbia. Simon Fraser, in one of the most daring journeys in the history of exploration, followed the same turbulent river to the sea in 1807, and only realized when he reached its mouth that it was not the Columbia. David Thompson, in 1807-1811, explored every foot of the real Columbia, and its great tributary the Kootenay, from source to mouth. By the year 1811, therefore, these pioneers of the fur trade had opened new thoroughfares from the passes of the Rocky mountains to the sea, and in the decades that followed brigades of canoes, with their valuable cargoes of skins, set forth periodically from Fort Simpson, near the mouth of the Columbia, to cross the continent to York Factory on Hudson bay, or Montreal on the far-off St. Lawrence.

Between the years 1834 and 1850, John McLeod, of the Hudson's Bay Company, and Robert Campbell and J. Bell of the same company, had opened new highways of the fur trade in the far north-west, by their explorations of the Liard, Dease and Stikine rivers, and the Pelly, Yukon and Porcupine. By the middle of the nineteenth century, therefore, no quarter of the northern half of the continent remained inaccessible to the adventurous fur-traders who still held undisputed sway over the greater portion of this immense territory; a sovereignty made possible by reason of the extraordinary network of waterways intersecting the land in every direction—the highways and byways of the fur trade.

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[1] Search for the Western Sea, xliv–xlv.

The Capture of Oswego by Montcalm in 1756; a study in Naval Power; with an Appendix of letters from Housman Broadley, Commander of the British Forces on Lake Ontario.

By W. L. GRANT, F.R.S.C.

(Read May 27, 1914.)

THE CAPTURE OF OSWEGO IN 1756.

The Seven Years' War is the paradise of the historian, epic in scope and romantic in detail; far enough away for the student not to be engulfed in shoreless floods of paper, yet near enough for his material to be abundant and accessible. Of unpublished manuscripts the Public Record Office in London, the Departments of Foreign Affairs and of the Marine in Paris are full. Of all of these there are certified copies easily accessible in the Archives of the Canadian Government at Ottawa, and of many in the Archives of the Provincial Government at Quebec. Every now and then new documents are found in the escritoires or lumber-rooms of private families; for example, Mr. Thomas Chapais of Quebec, whose admirable "Life of Montcalm" I shall have occasion to refer to later, has been privileged to consult a number of memoirs and other documents drawn up by M. de la Pause, adjutant (aide-major) of the Regiment of Guienne, so efficient an officer that the grateful Montcalm, anticipating the description given by Pitt of Clive, spoke of him as a heaven-born soldier.

The printed material is also abundant. If we take one such incident of the war as the Siege of Oswego in 1756 we have the printed diaries and reminiscences of such men as Pouchot,[1] Malartic,[2] and Des Androuins.[3] We have the correspondence of the Board of Trade with the Governors of New York in "New York Colonial documents," Vol. VII, and some important French papers in Vol. X of the same series. Above all we have the 11 volumes of the so-called "Levis papers," edited for the Government of Quebec by the late Abbé Casgrain[4]. These include numerous letters, describing all phases of the

[1]Pouchot. *Memoir upon the late war in North America, 1755-60.* Tr. and ed. by F. B. Hough. (Roxbury, Mass, 1866.)

[2]Comte Maurès de Malartic. *Journal des Campagnes au Canada de 1755 à 1760.* Ed. by Paul Gaffarel. (Paris, 1890.)

[3]M. L'Abbé Gabriel. *Le Maréchal de Camp Desandrouins.* (Verdun, 1887.)

event, written by Montcalm, Bourlamaque, Bougainville, Bigot, Vaudreuil, etc.

This material has already been carefully gone over. It is the good fortune of Canada that her history under the French regime has been written by one who is perhaps the greatest historian produced by North America, Francis Parkman. The brilliance of his style has sometimes caused dullards to doubt the solidity of his learning. Having had occasion more than once to go into all the material available for the study of some small incident narrated by Parkman, I have invariably found that he had left practically nothing unread and that his brilliance wells up from a rich spring of knowledge and of study.

Yet there is a sense in which even Parkman is inadequate. Compare his two volumes on "Montcalm and Wolfe" with the more recent volumes on "England in the Seven Years' War" by Mr. Julian Corbett; it is at once apparent that one was written before, the other after Admiral Mahan had produced his series of works on Sea Power, which have done so much to revolutionize and to widen our conceptions of military history. Not indeed that Captain Mahan discovered, or would claim to have discovered, the doctrine of sea power. His own chapters show that that doctrine was thoroughly known to the great Pitt or to the English Admiralty in the struggle with Napoleon. But before Captain Mahan, knowledge of the doctrine was the privilege of a few statesmen, denied to historians. It is indeed true that belief in the importance of sea power may be pushed too far. We must not let Wolfe and Montcalm fall too far into the shade of the Admirals of the fleet. Yet after giving full credit to the rival Generals, the fact remains that in reading Parkman we feel a gap which must be filled in by later writers.

The same is true of such an incident as the capture of Oswego by Montcalm in 1756. The details of the siege have been given by Parkman, or with equal vividness and greater detail by M. Chapais, but the importance in the siege of the control of Lake Ontario by the French has yet to be brought into relief.

Oswego was garrisoned by about 1,600 men, mainly regulars, under the command of Colonel Mercer. During the winter of 1755-6 these had suffered terribly from scurvy[1], but the British were fully alive to the importance of the post, and in the spring of 1756 had sent

[1] On 4th January, 1757, the Earl of London enclosed to the Secretary of State an account of the siege by Captain John Vickers of Shirley's (50th) regiment. It has been quoted in part by Parkman, but he has omitted one sentence, which I must give: "When I left Oswego the garrison were pretty healthy, as it consisted mostly of recruits just come out, the men that composed the garrison in the winter being mostly dead."

up reinforcements, including the celebrated engineer, Patrick Mackellar[1].

Meanwhile the French were concentrating at Fort Frontenac, then often known by its Indian name of Cataraqui or Cadaraqui, the modern Kingston. In the early spring they had also formed a permanent camp of Canadians and Indians at Niaouré Bay, the modern Sackett's Harbor. In May Montcalm, the new French Commander in Chief, reached Montreal, and went down to watch the centre of the British position at Ticonderoga. Satisfied that De Levis, his second in command, could hold the British in check with the forces at his disposal, he determined on a bold exploit. On 16th July he left Ticonderoga; travelling day and night he was at Montreal on the 19th. After a conference there with Vaudreuil, the Governor, he set out on the 21st, and on the 29th reached Fort Frontenac. A week of devouring activity followed. The militia were drilled, the Indians exhorted, over 200 batteaux got ready and loaded with provisions, arms, and artillery. On the evening of the 4th August he set out, spent most of the following day on Wolfe Island, and on the 6th August reached Sackett's Harbor, where on the 7th he was joined by the first division of his forces. On the 8th August the Canadians and Indians moved forward to Anse-aux-cabanes, less than 10 miles from Oswego. On the same day the second division from Kingston reached Sackett's Harbor. On the 9th August Montcalm set out from Sackett's Harbor and reached Anse-aux-cabanes that night. On the 10th he pushed forward, and concentrated 3,000 men with ample stores and over 80 cannon within a mile and a half of the Fort before the British were aware of his presence.[2] Seldom was surprise more complete. On the 12th August there was some hard fighting. On the 13th Fort Ontario on the east bank of the Oswego river was evacuated and its garrison retired safely across the river to Fort Oswego. During the night Montcalm threw up batteries, by a shot from one of which Colonel Mercer was killed on the morning of the 14th. A few hours later the Fort surrendered.

All this is told in graphic fashion with abundance of detail by Parkman and by M. Chapais. M. Chapais also discusses with admir-

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[1] The account of Mackellar in the Dictionary of National Biography gives an inaccurate and indeed absurd account of his supposed defence of Oswego.

[2] 21st August. The Earl of Loudoun, Commander in Chief in North America, to Henry Fox, Secretary of State. French deserters from the Marine Companies who had reinlisted in Shirley's and Pepperel's Regiments and escaped from Oswego had come in and testified "that on Monday, the 9th, the garrison sent out a row galley, the crew of which upon their return reported that they had seen the French camp at about 1 mile distant from Fort Ontario." See also Captain Broadley's letters of 15th Nov., 1756, and 22nd Jan., 1757, in Appendix.

able fairness and fullness of knowledge some of the various controversies which have arisen. Frenchmen of New and of Old France still discuss whether Canada was lost through the fault of the home Government or of the colonists. The dispute has ramified; every incident is discussed; much ink has been spilt on the question whether it was the Canadian Vaudreuil or the French Montcalm who planned the brilliant enterprise which I have outlined. On the morning of the 14th a body of Canadians and Indians under Vaudreuil's brother Rigaud crossed the river. Was it this movement which determined the surrender or was it comparatively unimportant? On both these controversies the last word seems to me to have been said by M. Chapais.

Does nothing remain to do? Surely there are one or two puzzles to be solved. On the 22nd July the English had heard through their scouts of the camp at Niaouré Bay.[1] The English had on the lake vessels of force which came out of harbor on the 11th of August, but were beaten back by the small French fleet and the shore artillery. Why had these vessels not reconnoitered the camps at Frontenac and at Niaouré Bay and brought word of the preparations? Why had they not pounded to pieces the light batteaux as they skulked along the coast? The more we read of the French advance the more we see that Montcalm was extremely apprehensive. In his orders[2] he gives the most minute instructions on what is to be done by the batteaux and the land forces should a strange sail appear, and the signals which are to be made by the French fleet whenever they come in touch with their own forces or with the enemy.[3] Reading the siege

[1] 22nd July. Mercer at Oswego to Shirley at Albany. Has news from an Indian prisoner of the French concentration at "Cadaraqui," who "design to attack us the next new moon." From the Indian and from scouts has news of the camp at Niaouré. He is doing all he can to put the place in a state of defence, giving out stores and rum, even against orders; taken, though without money, the stores of the traders, etc. "The Snow is launched, a fine vessel, and had we sailors, guns and rigging I'm in great hopes we might command the lake."

[2] His order book is a recent acquisition of the Canadian Archives.

[3] Vaudreuil had at first intended to dismantle the French ships, and to use their crews and guns as part of the land forces, but in his final instructions to Montcalm, he wisely left the decision to the general on the spot.

Vaudreuil's orders to Montcalm, 21st July, 1756.

"Quoique nous ayons donné ordre à M. de Bourlamaque de faire désarmer les barques et les faire mettre sous la protection du canon du fort, leurs canons et leurs équipages pouvant être employés à l'expédition de Chouaguen, néanmoins, si M. le Marquis de Montcalm estime plus utile au bien du service, de les conserver armées nous nous en rapportons entièrement à lui."

Instructions of Montcalm to M. de l'Hopital, Lt. Col. of the Reg. of Béarn.

M. de l'Hopital est prévenu que la Marquise et la Hurault croiseront, si le vent leur permet pour la sûreté de nos opérations et pour qu'il n'y ait point d'équivoque,

with this in mind it becomes evident that here again we can supplement Parkman, that Oswego was lost not only owing to the superior generalship of Montcalm and the superior spirit and gallantry of his troops, but owing to the loss of the control of Lake Ontario. The men might indeed have been marched through the woods, but without naval supremacy the heavy guns which were essential to success, could not have been transported. As Captain Vickers said: "Fort Ontario could not be taken with small arms only by 10,000 men."

The Commander-in-chief of the British forces in North America during the early part of 1756 was William Shirley, Governor of Massachusetts Bay, a lawyer who had long burned to exchange the pen for the sword. He was active and energetic, but his ability as an administrator is open to doubt. It seems evident that he carried contempt for red tape to a disorderly excess. Important plans were kept not on paper, but in his head; important orders were given only verbally. Early in July, influenced by a cabal of his enemies, the British Government sent out orders as remarkable as any which ever entered the head of the author of "The Bab Ballads." Shirley was to be superseded by Colonel Webb, who was in his turn to hand over the command to General Abercrombie, who in his turn was to hand it over to the Earl of Loudoun. The natural result of this remarkable arrangement was that the British campaign was "all action and no go." Each Commander-in-chief consumed valuable time in giving over to his successor an account of what he had done and in justifying his actions. All with one accord fell foul of Shirley. All three were narrow-minded military men, bitterly jealous of the civilian soldier, in whose irregular methods they found some just cause for complaint. While they lingered and haggled, and wrote recriminatory dispatches to the Secretary of State, Oswego was lost.

Shirley had seen the importance of keeping the control of the Lake. In a Council of War held at Oswego on 18th September, 1755, one of the five points discussed had been "whether it will not be advisable for his Majesty's Service, to prepare materials here this winter, and build, as soon as may be, one or more vessels of a larger

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il leur a été ordonné si elles nous aperçoivent, de faire des signaux soit de jour ou de nuit, et de leur répondre. Je les joins à la présente instruction ce 4 Août 1756."

Instruction pour le sieur Laforce.

La Marquise and *Le Hurault* shall put to sea fully armed. The *Victor*, unarmed, shall go to Niagara to carry the effects of the voyageurs. The *Louise* shall be disarmed, and left with two of her crew on board. The remainder shall man and arm the English prize, which shall convoy the provisions for the Reg. de Béarn. The *Marquise* and the *Hurault* shall cruise off Oswego. and shall attack any English vessels which come out, "sans se compromettre s'ils se croyent inferieurs en forces." An elaborate system of signals follows, and is sent to Rigaud and others.

size than the largest of those already built, and capable of mounting 10 six pounders, besides swivels, and also two more Row gallies, and 100 more good Whale Boats," and "the Council also unanimously agreed that the building the Vessels proposed by his Excellency is highly necessary." In a later Council at New York held on December 13, 1755, Shirley made known his instructions, which included the erection of such a fort at Niagara "as shall for the future make his Majesty's subjects masters of the Lake Ontario; and that if, for this purpose, the said late General Braddock should think it necessary to have ships upon the said Lake Ontario, he should concert with the commander in chief of His Majesty's ships, and the governors of New England and New York the manner and means of building and manning such vessels, as shall be most proper for that service."

In the same council of December 13, Shirley points out the strategic importance of Kingston: "that whilst the French are in possession of that Fort, and the harbour there, with a free passage into the lake through the River Iroquois, together with their harbour at Toronto on the lake, they will have it in their power to build and maintain vessels of force upon the lake, which, unless his Majesty shall keep up at least an equal force there, may not only greatly annoy any Fort which should be erected by his Majesty's subjects at the North East end of the Pass at Niagara, but endanger the loss of Oswego itself to the French, which would inevitably be attended with the defection of the several castles of the Indians of the Six Nations to the French interest in a short time, and with the loss of the whole country as far as Schenectady, and very possibly be soon followed with the loss of the city of Albany . . . . . His Excellency then acquainted the council, that immediately before his departure from Oswego, as well as since, he had received intelligence that the French are building at least three large vessels of force in the harbour of Cadaraque, which, together with those they had already built, will be much superior to those built by us in the Lake, whereupon he likewise desires the opinion and advice of the council concerning his causing more vessels to be built, and if a larger Force upon the Lake, than what his Majesty hath there already, and how many such vessels it is necessary to have built for gaining the mastery of that Lake."

The Council, after taking these several matters into consideration, gave it as their unanimous opinion, "1st. That it is most essentially necessary at all events to secure the navigation of the Lake Ontario, and from the intelligence the general has informed them he has already receiv'd of vessels building by the enemy at Fort Frontenac, that at least three vessels be built immediately at Oswego, of as large a size and force as the depth of the water at the entrance of the harbour

of Oswego will admit, and that on any future intelligence of the enemy's increasing their naval force, that the General should build such and so many more vessels as he finds necessary for securing the mastery of that lake."

Early in 1756 Capt. Housman Broadley was sent up to command the fleet,[1] and on 25th May, 1756, Shirley informed his Council of War, "That the naval force upon the lake will consist this year of two vessels of ten carriage guns each, built last year, and one vessel of eighteen, one of ten, and another of eight carriage guns, for building and equipping of which preparations have been making at Oswego some time, and which were three months ago ordered to be built and equipped as soon as possible this year; and that there will be 250 whale boats for the navigation of the Lake, capable of holding 16 men each."

Meanwhile, however, everything was going wrong. In a dispatch of Lord Loudoun, written on 3rd October, 1756, is enclosed a report from one George Dunbar: "February the 26th . . . . came up 40 carpenters, for building new vessels, but could not employ them, for want of guards for them in the woods, and also no provisions to supply them with, according to their contract." The lot of the unhappy carpenters was hard, for on May 11 "ten carpenters were killed and three taken by the Indians in the face of the Fort." Nothing could better show the demoralization of the garrison. The officers in command were well aware of the importance of naval control. On 25th May Mackellar wrote to Montressor, "I intended according to his Excellency's orders to have set abroad repairing the most material and least costly of these defects immediately after my arrival and spoke to Colonel Mercer the commanding officer upon that head who immediately consulted some of the principal officers and it was agreed that as they were under no apprehensions of a siege the work of the shipping was the most requisite to be forwarded and that as the weakness and sickness of the garrison would not admit of them giving a sufficient number of men even for that service, the other work must be postponed until the hurry of that business should be got over."

[1] May 7, 1756. Shirley to Fox.

"I am likewise, Sir, to acquaint you that the Commanding officer of the vessels built on the Lake Ontario the last year is gone to Oswego, with a sufficient number of sailors to fit them out as soon as possible; and 100 carpenters are gone there to build three vessels more, 30 of which have been at work on them above five weeks, and the stores for them all are on their way to Oswego."

See also Broadley's letters in Appendix.

Shirley endeavoured to hurry up supplies from Albany, but delay after delay occurred, especially at the great carrying place at the head of Oneida Lake. On June 28, Captain Broadley writes to headquarters that while on board the *Oswego* sloop with the *Ontario* and a small schooner in company he was chased by four French vessels into Oswego, and from other sources we know that the small schooner was captured. He goes on to say, however, "the new sloop will be ready to launch in four days, and the brig in eight days . . . . . . The brig is eight ports on a side and the sloop six."

On July 2 he writes "that Captain Bradstreet has arrived from Albany with a convoy but no guns for the new vessels. The brig will answer very well, but the Snow will not. Nor are there either guns for her, or sails, or a sailmaker to make them of the brig's sails."

The running rigging for the new vessels "has in a great measure been made use of for painters for whale boats or battoes, and but one small anchor and two cables here as yet." Bradstreet has sent down to Schenectady for the missing guns and stores; the guns are 6 6-prs., 4 10-prs. 14 swivels, and double headed shot.

7 July. No nails. Superiority of the French vessels. About 30 seamen needed. "I think it would be for the good of his Majesty's service to build a small schooner in the place of the one that is taken . . . I have great reason to believe from information I have received that many of the stores designed for the use of the navy have been stop'd at the carrying places for the use of the forts built and a-building there."

15 July. The want of nails "has obliged the smiths to work day and night to supply nails and other iron work for the vessels. The brig and sloop are now rigged and their sails bent, but there is still some carpenters and smiths work to be done on board them."

"The Snow will be launched in three or four days", but there is great lack of rigging, though he has endeavoured to improvise some.

"I shall go to sea with three of the vessels," but have not guns for more.

What the British fleet did, or rather did not do, during the last days of July and the beginning of August, is set forth in Broadley's own letters. It put to sea, had a series of misfortunes, damaged its most powerful vessel, and returned to harbour. In any case it was inferior to the French, and when a detachment ventured out of harbour on August 11th it was easily beaten back.

After the fall of Oswego a long and acrimonious discussion ensued between Shirley and Loudon, Shirley pleading vehemently for an investigation, which the easy-going Lord Barrington at the War

Office was slow to grant. Shirley's whole defence shows that he knew where the blame lay. His main line of argument is that had the ample naval stores which he had provided been rushed up to the front the ships could have got ready in time and Oswego rendered unassailable. Blame for this he lays on the conduct of Colonel Webb and on his slowness at the "great carrying place."[1] No reply by Webb is known to me to exist and his precipitate retreat after the fall of Oswego and his cowardly refusal in the next year to march to the relief of Fort William Henry render Shirley's accusations extremely likely.

Such is Shirley's defence. How much of the blame must be put upon his own lack of organising ability is doubtful, but the conclusion seems inevitable that he had fully and correctly realized that the

[1] Shirley to Fox.

5 Sept., 1756. "At present shall only add to the state of the facts here, that one unhappy consequence of the delay of the battalions, which waited for the 44th Regt., was that some of the new vessels, and of the greatest force, and which were much depended upon for the defence of Oswego, could not act upon Lake Ontario for want of cannon."

Shirley to Fox, 16 Sept., 1756.

Fifteen pages of his reasons for the fall of Osewgo.

There should have been built last year—2 vessels of 10 guns each; 2 small schooners (used as row gallies) of 10 swivels each; 3 vessels, built this year of 18, 16, 12 cannon; 250 whale boats of 16 men each.

These would have been enough to keep control of the lake. Most of them were ready, except 20 cannon which had waited at the Oneida carrying place.

The whole thing was upset by Loudoun's & Abercromby's delay after Shirley's supersession, which prevented Bradstreet from carrying up the remaining stores and guns. "In such case the whole naval armament might have been out upon the Lake Ontario, in time to have prevented the French from landing their men and artillery near Oswego, or even from venturing to appear on the lake."

Later in the letter he recurs to this: "I must proceed to observe that at the time of its being attacked by the enemy, it was deprived of the naval armament designed for its protection, by Capt. Bradstreet's being kept with the battoes, and battoemen at Schenectada from the 11th July to the 12th August: for the 20 peices of cannon, which lay at the carrying place, and the battoemen had been at Oswego by the 1st August, which would have been the case, had it not been for that delay, our whole naval force might have been upon the lake, and prevented the embarcation or at least the landing of the French with their cannon and stores near Oswego; whereas for want of those 20 peices of cannon two of our best vessels were without any, consequently could not appear on the Lake, and without their assistance and that of our whale boats and battoemen, or at least such a part of them as was necessary for manning the whale boats, our other vessels were not strong enough for the enemy."

Why were they detained? News of the camp at Niaouré had been given by Bradstreet to Abercrombie at Albany, on 10 or 11 July, and Webb and the 44th were told to be in readiness for Oswego; but they were delayed till 12 August, owing to disputes about provisions, etc., though Loudoun had arrived at Albany thirteen days before.

defenceno fOswego rested upon control of the lake, and that had the British avagl forces on the lake been brought up to the strength which he had desi ned, all the skill of Montcalm, and the dash and enthusiasm of the French and Canadians, would probably have been vain.

APPENDIX.

Extracts from the Letters of Captain Broadley in the Public Record Office.

Adm. Sec. In Letters. Vol. 480.

p. 1305.

OSWEGO SLOOP AT OSWEGO, 15th Sept., 1755.

Sir

I accquainted you in my Letter of the 21st Augst that his Excellency Major General Shirley &c. had order'd the Ontario to be made a Sloop of, she was launched the 24th Augst., and join'd me on the Lake the 9th Sepr., she sails extreamly well, and is in every respect a much better Vessel than the Schooner I command. Upon my Return here on the 13th & accquainting Major Gen. Shirley how well the sloop behaved, we came to a Resolution to alter the Oswego as soon as the intended Expedition is over which will be attended with a very small Expence, as the Carpenters are here that built her. I wrote to Mr. Keppel upon my leaving New York to accquaint him that the Seamen which was provided for me there, was contracted to serve no longer than the latter End of October, and that their wages was three Pound ten shillings New York Currency p. mensm. the seamen for his Maje. Sloop Ontario that Major Genl. Shirley &c., brought with him are contracted to serve untill the latter End of Novemr. at much the same Wages, which I thought was proper to accquaint you of, and that there will be no getting Seamen at New York or Boston to come up early in the Spring, upon the Wages allowed in the Navy. Inclosed I send you the Weekly Account of the two Sloops and am, Sir, Your most humble servt.,

HOUSMAN BROADLEY.

(A Copy—R. Spry).

To the HONBLE. EDWD. BOSCAWEN,
Vice Admiral of the Blue, &c.

p. 1306. Endorsed:
Capt. Broadleys letter from Oswego. Dated 15th Septr., 1755.

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p. 1311.

OSWEGO SLOOP AT OSWEGO the 20th Octor,. 1755.

Sir

In my letter of the first of October I informed you of the Intended Expedition against Niagara being put off, I sailed on the 2d with the Ontario, and one of the small Schooners in Company, to Endeavour to discover, as far as I could to the westward. After geting about thirty Leagues the Weather was so bad and the Season so far advanced, I thought it would be running too great a Risk to continue

any longer out. On the 8th I bore away and got in here, with the small schooner as did the Ontario the Morning following. The weather continuing so bad, and the time for my men to be discharged being nigh out, I am unrigging the Oswego, in order to lay her up for the Winter. The Ontario I shall Order to keep ready for Sea, in case there should be Occasion for her to go out, before the time is expired that her men are to serve. Upon my Consulting with Major General Shirley, Commander in Chief of his Majestys Forces in America, about the Naval Force to be on the Lake next Spring; and about the stores, and Seamen for the Vessels here; he told me it was absolutely necessary for His Majesty's Service, that I should go down to provide them, which (as there can be no service for the Vessels from this time untill the Spring) I shall do, and leave the Command of the Vessels here to Captain Laforey and proceed to New York, where I hope I shall meet with some Orders from you concerning them. Inclosed attends you the Weekly Accounts of his Majesty's Sloops the Oswego, and Ontario.

I am, Sir,

Your most humble servant,

HOUSMAN BROADLEY.

TO THE HONBLE. EDWARD BOSCAWEN, (Copy).

Vice Admiral of the Blue, &c., &c.

Endorsed:

Letter from Capt. Broadley at Oswego. Dated 20th Octr., 1755.

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p. 1371.

NEW YORK the 14th Jany., 1756.

Sir

I received your Letter of the 13th of Decr. and with it an Order, to put myself under your Command.

At the Congress of the American Governours here, they came to a Resolution to Build three more Vessels at Oswego, which Resolution they came to, upon having Intelligence that the French were Building some Vessels at Quadroque.

They are to be two Brigs and a sloop, the Brigs to have twenty five seamen each, and the sloop twenty, which with the Complements of his Majesty's sloops Oswego, and Ontario, Amounts to upwards of a Hundred Seamen, that will be wanting, which I am afraid shall not be able to get here, or if we do, it must be at the wages the merchants give at this Port, which greatly exceeds the Kings Pay.

General Shirley who sets out for Boston to morrow, desires I will let you know he has received your Letter, and that he will send an Express to you upon his Arrival at Boston in which he will Acquaint you of the Building these Vessels, and leave it to you in what manner they are to be Commanded.

Inclosed attends you a Copy of Mr. Keppels' Orders which are directed to Captain Owen, as he was first appointed for this Service, upon his being removed, I had an Order to receive them from him: I likewise Inclose you the Dimentions of the Vessels that are to be Built, which we are Obliged to conform to, as there is but between Seven and Eight feet Water in the Summer and Fall of the year, at the Entrance of Oswego Harbour.

I am

Sir

Your most humble Servant

HOUSMAN BROADLEY.

RICHD. SPRY ESQR. (Copy—R. Spry)

Endorsed;

Capt. Broadley's letter dated the 14 Janry., 1756.

Adm. Sec. In Letters. Vol. 1487.

NEW YORK the 14th of Janry 1756.

Sir

On the 24th of November, I inclosed the Journals of his Majestys Sloops Oswego and Ontario to you. Since which there has been, a Congress of the American Governors here, at which, (upon Intelligence that General Shirley had received, that the French were building some Vessels at Quadroque) they came to a Resolution, to build three Vessels more at Oswego; They are to be two Brigs, and a Sloop, the Brigs to have twenty five Seamen each, and the Sloop twenty.

Inclos'd attends you a Coppy of their Dimentions, which we are obliged to build upon, as there is not in the Summer, and fall of the Year, more then between Seven and Eight feet Water, in the Entrance of Oswego Harbour.

I have Acquainted the Commanding Officer upon this Continent of these Proceedings; and shall wait, as long as the Service will admit, to have some Directions from him, about these, and the other Vessels that are already there.

I am Sir

Your most Humble Servant

HOUSMAN BROADLEY.

Minutes.

15 Ma. The two Brigns. to be called the London & Halifax

To have each

3 Commanders & 2 Senr.
2 Lieut. & 1 Senr.
1 Boatsn. & Gunr. in one
1 Carpenter
1 Mate
1 Mid.
1 Qr. Master
24 Seamen
1 Surgeon
1 Steward & Clk in one.
—
36

The Sloop to be called the Mohawk

3 To have Commander & 2 Senr.
1 Mate
1 Midsn.
1 Boats & Gunr. in one.
1 carpenter
1 surgeon
1 steward & Clerk in one
17 Able Seamen
—
26

Orders to the N Bd. & Captains to Establish them accordingly., & to be put in the List of the Navy.

Let Capt. Broadley know I have Communicated his Letter to the Lords.

Pray Sir

Are not the Brigantines & Sloop to have surgeons & Surgeons mates—?

Each to have a Surgeon but no Mate

Adm. Sec. In Letters. Vol. 1487.

DIMENSIONS OF THE VESSELS TO BE BUILT AT OSWEGO.

Two Brigantines
60 feet Streight Rabbit.
21.....Beam
7.....Hold

	feet		feet
Main Mast to the Hounds	53	Head	7
Do. Topmast to Do	23	Do	3
Do. Boom	54	Extream Length	
Do. Topsail Yard	26	Extream Length	
Cross Tack Yard	30	Extream Length	
Fore Mast to the Hounds	42	Head	8
Do. Topmast	28½	Do	3½
Do. Top Gallant Mast	15	Do	3½
Do. Yard	42	Extream Length	
Do. Topsail Yard	32	Extream Length	
Do. Top Gallant Yard	21	Extream Length	
Bowsprit	38	Extream Length	
Jib Boom	28	Extream Length	
Sprit Sail Yard	30	Extream Length	

One Sloop
45 feet Streight Rabbit
18......Beam
7......Hold

	feet		feet
Main Mast to the Hounds	58	Head	7
Bowsprit	43	Extream Length	
Main Boom	59	Extream Length	
Square Sail Yard	26	Extream Length	
Jib Boom	26	Extream Length	

	Ft.		Inch
Snow's length of Deck	80	"	6
Breadth extream	22	"	
Length of Keel for Tunage	66	"	10¼
Depth in Hold	8	"	7
Depth in Waiste	3	"	6
From the Upper side of the upper deck Plank to the under side of the Quarter Deck plank	5	"	9
Fore Castle Do	4	"	11
Height between ye. Deck & ye. Plat forms	5	"	2
Burthen in Tons	172 "/ 94		
Length of the Keel streight Rabt.			

	Length	Diamr.	Long	Diamr.
Main Mast long	54	1 " 3 Yard	44	10½
Top Mast	31 " 4	9¼	31 " 9	8½
Gallt Mast	16	5¼yd.	18 " 6	5
Fore Mast long	49	1 " 2 yd.	38 " 6	10

Top Mast Do	29	0 " 9 yd.	27 " 6	7¾
gallt. Mast Do	14 " 6	0 " 5 yd.	16	4½
Bowspreet in Length	33	0 "11½yd spr	27" 6	7¾
Flying Jibb Boom	25	0 " 5		

Acknowledged by J. C. (John Cleveland) on 6 Apr. 1756.

Adm. Sec. In Letters. Vol. 1487.

Oswego Sloop at Oswego ye 20th May 1756.

Sir

I Received your Letter Dated October the 2d. at Albany, in way here with an order to be perticularly Carefull about the Goodness & the Prices of Slops Supplyed too the Sloop under my Command which I shall take Perticular Care whenever we are Supplyed with any to obey

I am

Sr. Your most Obt. Servt.

Housmn. Broadley.

To John Cleveland Esqr.

Read

Adm. Sec. In Letters. Vol. 1487.

Oswego Sloop at Oswego May 20th 1756.

Sir

I acquainted you in my Letter of the 14th of January of their Intending to Build three more Vessels at Oswego, two Briggs & a Sloop a Copy of their Dimentions I sent you at the same time

I Left New York the 20th of March with the Seamen for the Present Vessels here; two Days after I gott to Albany, we had the Account of the Fort at the other Side of the Great Carrying Place being Destroyed by the French & Indians, & that Lieut. Bull of Generall Shirleys Regiment, who Commanded there with a party of Twenty five Men were all Killed—

I was Detained at Albany geting the Naval Stores sent over to Schenectady until the 8th of April on the 9th I Left Schenectady with the Stores that were wanting for the Present Vessels, but Could not Get Batteaus to Carry any Part of the Stores for the New Vessels, on Account of the Great want of Provisions at Oswego, as we were obliged to Proceed with a great Number of Boats & Men to Guard against any attack the Enemy might make upon us, & through the want of Horses & Slays at the Carrying Places I did not get here untill the 13th Instant, I immediately began to fit out the Present Vessels, as I wanted a False Keel put on the Oswego, I order'd Capt. Laforey in the Ontario to heave down first which was done this Morning, I shall heave down too Morrow, if the Carpenters get my false Keel Ready, and the Caulkers finish their Work, I am Likewise fitting out the two Small Schooners as soon as we are Ready shall proceed on the Lake to put my former orders in Execution I have Brought Seamen Enough with me to Compleat the, Compliments of the Present Vessels, but as the Navy Provisions is not Come up I refer sening you a Weekly Account untill that arrives—

The Keel of one of the New Briggs is Laid the others will be Laid in a Day or two, so that they will all be on the Stocks together, the reason of their being so backward, was owing to the Loss of the Fort at the Great Carrying Place, for the Builder & Carpenters did not proceed any further then Fort Williams untill we arrived with the Escort that Came with us, there was some Carpenters sent up

in the Winter but as there was Continually Scalping Parties about this place they did very little; There was the day before I got here, Eight of them Scalped & Four Carryed off Prisoners, the Day after I gott here, Lieutt. Blair with a Party of Twenty Five Men that were sent to protect the Batteaus Coming down here was Attack'd about a Mile from this Place, Blair and two of his Men kill'd we killed it is Imagined Five or Six, Two of which we gott the others were Carried off

I am Sr.

Your most Humble Servt.

HOUSMN. BROADLEY.

Minute.

31 Augt.

Let him know I have Communicated his Letter to the Lords who approve of his proceedings, and have appointed him to command the Jamaica Sloop

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Adm. Sec. In Letters. Vol. 1487.

OSWEGO SLOOP AT OSWEGO the 19th June 1756.

Sir

I inform'd you in my Letter of the 20th May that I was geting the Vessels here ready for Sea as fast as Possible, and that the Keel of one of the Brigs was laid, and that the others would be laid in a Day or two, which was done, but the Day after the Keel of the last Brig was laid, there came another Builder here from Genl. Shirley, to build a Snow (in the Place of one of the Brigs,) to carry Eighteen Six Pounders, a Copy of her Dimensions I here inclose you, the Brig and Sloop will be ready to Launch in Ten Days, the Snow in about a Month.

There is sent up here by Genl. Shirley about Thirty five Seamen more than the Complement of the Oswego and Ontario, which I employ in the Small Schooners untill the other Vessels are launch'd.

I got the Vessels all ready for going out by the 1st of June, but had not an opportunity of Sailing before the 5th; which I did with the Ontario and one of the small Schooners, and proceeded about Forty Leagues to the Wt. wd. and after examining both Shores for that distance for Harbours for the Vessels found none. There are several Rivers on Each Side the Lake which I sent my Boat into, found none of them that had Water enough for the small Schooner.

There is very good Anchoring on both sides the Lake in many places close to the Shore.

As we proceeded to the Wt. wd. we found the Current set to the East wd. about one Mile an Hour and as we have very seldom anything but Wterly. Winds makes it very difficult getting to the Wt. wd.

I retd. here on the 17th and shall sail again to day if the Wind permits. The Naval Provisions is not yet come.

I am Sir

Your most Humble Servt.

HOUSMN. BROADLEY.

To JOHN CLEVLAND ESQR.

Adm. Sec. In Letters. Vol. 1487.

Copy transcribed in C.O. 5. Vol. 47 pp. 123-6.—M. 205 pp. 77-9.

OSWEGO SLOOP, AT OSWEGO June 28th 1756.

Sir

June the 27th being about Twenty two Leagues W N W from Oswego, the Ontario and one of the Small Schooners in Company, the Wind Westerly, we Stearing S E, at ½ past 3 in the Morning saw two Sail in the N W Quarter, upon which I wore and stood towards them, they at the same time coming down large upon us, at 4 Saw two more sail likewise bearing down, at ½ past four the two headmost being about two thirds of a Mile upon my weather bow, hall'd their Wind Tack'd clew'd their Main Topsls. up and laid them aback, one of them Hoisted a white Flag at his Fore Topmost head, & fir'd two guns, the other two Still coming down to them, At this time we plainly discover'd one of them to have Seven guns of a side, the other appear'd to be about the same Size, we saw plainly she had Eight guns mounted with Ports for more but could not distinguish if there was guns mounted in them, they both appear'd to be quite new, at this time I brought too & desired Capt. Laforey to come on Board me, upon Consulting with him & our Officers, it was unanimously agreed that as they were so much Superior to us it would be very imprudent to come to Action with them, the whole Strength of our Vessels being four four Pounders one three Pounder, and ten Swivels each, the Small Schooner Six Swivells, we with the Party we had from the Garrisson off Oswego, had 45 men each, the small Schooner Fourteen, upon which we bore away to the So. Et. and they after us, as I found we Sail'd better than the Small Schooner I order'd her to bear away more to the Et. Wd. which she did for some time & then hall'd up to the N. Wd, upon which one of the Sternmost french Vessels gave her Chase & very soon after Another of them stood to the No. Wd; the two largest followed us Untill near Eight, the Headmost of them Firing several chace Guns some of the Shott going over us, the Headmost of them at this time wore under Capt. Laforeys Stern & discharg'd her broadside they then stood to the N E after the other two, at Noon we lost sight of them they were all four of them Schooners, I can form no Judgment of the Strength of the Two Sternmost of them they comeing down end on upon us, but take them to be the two Vessels that they have had some time upon the Lake, I came in here last Night, & the Builder informing me the New Sloop will be ready to launch in four days & the Brig in Eight days, I have set all the Seamen to get every thing ready to get them out with the Utmost Expedition, and hope by the time we get them rigg'd the Guns & Sails will come up, the Brig has 8 Ports of a Side and the Sloop 6.

I am Sir

Your most Humble Servt.

HN. BROADLEY.

Ad. Sec. In Letters. Vol. 1487.

Copy transcribed in C. O. 5. Vol. 47. pp. 127–30.—M. 205. pp. 80–1.

OSWEGO SLOOP AT OSWEGO July 2d. 1756

Sir

I informed you in my last of the 28th of June, of our meeting with the French on the Lake the Day before; Since which there are Batteaus arrived with Sails, and Six Six Pounders, Ten Four Pounders and Fourteen Swivels, the Brig and the Sloop will be Launched tomorrow, which I shall fit out with all Possible dispatch, and distribute the Canon that is come up between them, untill ye others come up. Three of the French Vessels appear'd of this Place in the Evening of ye 28th, one of them chased one of the Small Schooners, that was out for intelligence, within three or four miles of the Harbour; the other Small Schooner I am afraid they have taken, as I have heard nothing of her, since the Day we fell in with the French Vessels.

As there is Timber enough Cut, with Iron and all other materials here, I thought it for the good of his Majestys Service, to build a Small Vessel as a Tender, in the Place of the one I apprehend is taken.

I am Sir

Your most Humble Servt.

HN. BROADLEY

TO JOHN CLEVLAND ESQR. &c.

7 July 1756. Broadley to Shirley. Copy.
Copied in C.O.5. Vol. 47. pp. 131-4.—M. 205. pp. 82-4.
15 July 1756. Broadley to Shirley. Copy.
Copied in C.O. 5. Vol. 47. pp .135-8.—M. 205. p. 85.
30 August 1756. Broadley to Loudoun. Copy.
Copied in C.O. 5. Vol. 47. pp. 823-6.—M. 205. p. 511.
30 August 1756. Broadley to Spry. Copy.
Copied in C.O. 5. Vol. 47. pp. 827-30—M. 205. p. 512.

Adm. Sec. Out. Letters. Vol. 705. p. 344.

31 Augt. 1756

Sir,

I have recd. and read to my Lords Commrs. of the Admty., your Letter of the 20 May last giving an Account of your Proceedings, & I am commanded to acquaint you that their Lordsps. approve thereof, and that they have appointed you to Command the Jamaica Sloop.

I am,

J.C.

Copy.

CAPT. BROADLEY,
Oswego, sent 14 Sept. by the Sutherland.

Adm. Sec. In Letters. Vol. 1487.

QUEBECK Septembr. 26th 1756.
Rd. 15 Novr.

Sir

I informed you in my Letter of the 28th of June, of our having fallen in with the French Naval Force on the Lake, and of our avoiding comeing to Action with them, they being so much Superior to us; at the same time I informed you, that the Brig and Sloop were to be Launched in a few days, and that I had Employ'd all the Seamen, to get every thing ready for them. In my Letter of the 2d. of July, I informed you, that some Batteaus were arrived, with some Guns and Sails for the New Vessels, and that three of the French Vessels chased one of the small Schooners into the harbour the Evening of the 28th the other Small Schooner they at that time had taken. On the 3d. of July, the New Sloop and the Brig were Launched, but very little of their inside, or of the Smiths work finish'd, which detained us until the 29th before we got them ready for the Sea. As there were no Officers come up for the New Vessels, I thought it was for the good of his Majestys Service that we should appear out on the Lake as strong as we could, with what Officers, men, and Guns we had got; for which Purpose I went on Board the Brig, with the Oswego's People, and took on Board her fourteen Six & Four Pounders, Giving the Ontario Six Four Pounders, and the New Sloop Four Four Pounders and the two Three Pounders, of which I order'd my Lieutenant, Mr. Deane to take the command. As I did not hear of any officers appointed for the New Vessels, before I Left New York, I brought to Oswego with me, By General Shirleys Particular desire, three People, who had been Masters of Merchantmen, to Act as Lieuts. of the New Vessels, untill farther orders; one of which Mr. Wm. Bedlow, I appointed to act as Lieut. of the new Sloop, and the other, Mr. Jasper Farmer, was taken in the Small Schooner. On the 30th of July, I Sail'd with the Above Force, on the 31st it Blowing very hard, the Ontario having Sprung her boom, and the Brig Carried away her Gaff, was Obliged to bear away for Oswego, to get new ones, which we got finished the same day. On the first of August, the wind being contrary could not get out, on the 2d. we Sail'd again. After being out two or three days found the Magazine of the Brig so damp, from her being built of all Green Timber, that a Great Number of the Cartridges were Milldew'd, which I thought to put a stop to, by keeping them in the Sun every opportunity. Upon Examining them the Sixth of Augst., I found some of the Paper quite Rotten, and the Bottom of some of the Cartridges dropping out; the New Sloop Labouring under the same inconveniency made it necessary for me to go in, to get some alteration made in the Magazine, to secure our Powder. On the same day in running into to Oswego, was taken with a violent Thunder Squall close to the Harbour, which after my getting through the Narrows, not being able to carry Sail, drove me ashore on the East Side of the Harbour, which obliged me to get my Guns and part of my Ballast out to get her off again, which we did the next morning, but as there was a Swell Rose very soon after she went ashore, which occasioned her striking upon the Rocks, it was thought Necessary to heave her down to Examine her bottom. on the 9th of August Hove the Brig Keel out, and found about three inches of her Keel rubb'd off, but was very soon obliged to Right, she making water through her upper works, they not being Caulk'd, on the 10th hove her out again, and Clapt on a false Keel of between three and four Inches, on the 11th hove out the other Side, and found she had rece'd no other damage. During the time of Heaving the Brig down, the small Schooner was sent out, upon Application from the Commanding Officer, both to the Et. w. and Wt. ward of the Harbour, to Look out. on the 11th at the time the Brig was Keel out, a Boat was discover'd off the four mile Point to the Et. ward, upon which the Small Schooner

was sent out, and soon made a Signal for seeing the Enemy, at Noon she returned, and informed the Commanding Officer, that there was a large Encampment upon the Lake side, behind the Fort call'd Ontario, on the East Side of the Harbour. Upon Consulting with the Commandant and the Field Officers, it was agreed to Send Capt. Laforey in the Ontario, and Mr. Deane in the New Sloop, out to reconniter their Camp, which was done as fast as Possible. Very soon after they were out of the Harbour Capt. Laforey being ahead, was fired upon, from a Point of Rocks, by three or four Peices of Cannon. About 4 in the Afternoon Capt. Laforey sent a boat in to acquaint me, that he had receiv'd three Shot, two below his Whale, one of which had carried away the Clamp of his Main beam, and rendered the Gun above it useless, and another Shot through his upper works, all of them twelve Pounders and desiring that I would have boats ready to assist him in, about 7 in the Evening the Sloops got into the Harbour. Upon Consulting with the Commanding officer the next morning, and my informing him, I should be ready with the Brig in the Evening to go out, it was agreed, to send the two Sloops out before, to Cruize off the harbour, which was done about 9 in ye morning— Upon my waiting on the Commanding Officer in the Evening, to acquaint him I was ready to go in the Brig, and to desire a Party of Soldiers from the Garrison, to go out with me, he told me there was to be a Council of War, the next morning very early, to Consult what was most Expedient to be done, both in regard to the Garrison, and to the Vessels, and desired I would not think of going out, as my Presence at that Council was absolutely necessary. I This Day as the New Snow was only Partly rigg'd, got all the Pitch, Tar, & Turpentine on Board her, and the Oswego, in order to have them ready to be burnt, before the Place was given up. The next morning, the Council of War, of all the Field Officers and Capts. in the Garrison met Early, and while they were Sitting, a Letter from Capt. Barford Commanding Officer at Fort Ontario, was rece'd, with a Copy of a Council of war, they had held there, in which they agreed, it was nigh time to abandon that Fort, as the Enemey's works, were approached very nigh them, and that if they waited for their Cannon being mounted, their retreat to this side of the water would be Cut off; Upon which it was agreed, that as that Fort could not Possibly hold out any time, when once their Cannon began to Play upon it, they should make their retreat to this Side of the water, in the afternoon, Upon which, I desired they would conscider, where the Vessels could be of most use, to the Garrison, upon which the Council of War were of Opinion, that the Brig should not go out, and that I Likewise should order the Sloops in, to strengthen the Garrison by the Party, they had on Board, and to Cover the Retreat of the Garrison from Fort Ontario. Upon which I sent off orders to Capt. Laforey, to come in wth. the two Sloops, which they did soon after. About Three in the afternoon, the Vessels being Placed, and every thing ready for the Retreat of the Troops from Fort Ontario, they Abandon'd it, and Cross'd the water unperceived by the Enemy. About 4 in the afternoon, the Enemy took possession of Fort Ontario; the Wind being now at N W, and blowing Fresh, there was no Possibility of the Vessels getting out, upon which Capt. Laforey and myself waited on the Commanding Officer, to Desire he would Call the Officers together again, to Consider the Situation the Vessels were in, which he Did, where it was agreed, that as the Garrison had Retreated from the other Side, they would spare us a Party from the Garrison, & that if the wind came fair, we should Endeavour to Run out in the Night, which we intended doing, but at the same time I desired to know, if we could not get out, whether the Vessels should not be destroy'd, but was answer'd, it would be time Enough to do that, when they were Obliged to Abandon the Old Fort, and the Commandg. Officer at the same time informed me, he had great Reasons to Expect Speedy Reinforcements from below; upon which we got the Party on Board and

Everything Ready for Sailing. The wind Continuing Foul untill towards Day Light, when it Came about for a Short time, but so little of it, and so Great a Swell upon the Bar that it was impossible to get out, at this time we discover'd the Enemy, had Raised a Battery of seven Peices of Cannon on the East Side, and soon after four more and a Bomb. Upon this I waited on the Commanding Officer, to acquaint him, that the Vessels could not get out, at which time, the Enemys battery Began to Play on the Old Fort; I then Applied to him, to Give us time to destroy the Vessels, before they retired to the Picketted Fort, Call'd Oswego, on a Hill on the West side of the Harbour, which he told me he should take Care About. I then Repair'd on Board the Brig, between seven and Eight we Perceived the Enemies Indians and Canadians Crossing the Water, at the Rifts above Oswego in Great Numbers upon which I order'd Mr. Deane who lay nighest, to them to Haul a Thwart the Harbour, and fire at them, but found they were to far off for his Guns to do any Execution. About this time Col. Mercer the Commanding Officer was kill'd, our Partys of Soldiers being order'd ashore, we agreed not having men Enough, to defend all the Vessels from being boarded, to retire on Board the Brig and Barricade her. About 8 the succeeding officer beating a Parley without previously acquainting me with it, prevented my setting Fire to all the Vessels, which I certainly should have done, had he informed me of his intentions time enough. I have enclosed a Copy of the Terms sent by the Marquis of Montcalm and accepted of, for the Surrender of the Garrison which was Deliver'd up to them the same day being the 14th of August The next Day all the Land & Sea Officers, were sent off in Batteaus for Montreal, and from thence to Quebeck, where the men were likewise to be sent, the greatest part of which are already arrived here, and are to be sent to Europe. By the Best Accts. we can get of the Forces, that were sent to Attack Oswego, they consisted of three Battallions of Regular Troops, which with the Canadians and Indians, amounted to about Four Thousand men, with a large Train of Artillery. Our Bagage which was secured to us by the Capitulation, was soon after Plundered by the Indians and Canadians Forceing into the Town, before the Regular troops could Cross the water to protect them.

I take the Opportunity of sending this by Mr Wm. Bedlow, who with Mr. Mc Funn, two of the Gentlemen I appointed to Act as Lieuts. who are sent home in a Flag of Truce, that brings the Greatest part of the Land Officers home upon their Parole. Capt. Laforey, myself and our Lieuts. are to be Sent to France, in the Outarde a French Store Ship, which/we expect will sail in a few Days.

I am
Sir
your most Obedient Humble Servt.
HOUSMN BROADLEY.

Adm. Sec. In Letters. Vol. 1488.

DEALE January the 22d. 1757.

Sir,

I received yours of the 19th of January with a Copy of the two paragraphs which seem to be a Charge upon me & the Comanding Officers of the two Vessels employ'd under me; it is true the day before the Briggantine was thrown ashore I received a letter from Collonel Mercer acquainting me that he had Intelligence of 30 Batteaus being landed 20 miles Eastward of Oswego; desiring me to stand in to see if they were there or not; which I did far enough to discover if any Batteaus were upon the shore side; and rather further then was consistant with the safety of the Vessels in that part, which I knew to be flat & to have some shoals of Rocks

run a large distance off the shore, but saw nothing: for if their Batteaus landed near that place there were several small rivers for them to put into; I don't recollect that Collonel Mercer proposed to me in his letter sending any Batteaus next day; and their Lordships will see in my letter from Quebec that my reason for comeing in then, was that the Powder in the Cartriges of the new Brigantine and new Sloop (for we were obliged to keep all our powder filled having no conveniency for filling in Action) through their Magazines being made of green Timbers just cut from the Woods, was so wet that we could not have used it; of which I convinced Collonel Mercer when I came in; as also that it would be impossible for the Vessels to cruize in the bottom of that Bay to intercept any Batteaus which might pass along the Bottom of it; they Coasting close along the shore; being able to land in ten minutes after discovering any Vessels, to haul up/their boats and shelter themselves in the Woods, where if we attempted to land in our small boats to destroy them we must have sacrafised all the People we sent; that Bay being likewise very dangerous for the Vessels particularly Captain Laforeys which would neither hold her wind, nor work) it being very deep and flat as it approached the shore; situated at the Bottom of the Lake into which the No. westerly winds almost constantly blow & make a very great sea; and indeed had the Vessels been in that Bay the next day, agreeable to Collonel Mercers desire as that paragraph mentions, the same violent gale of wind at N Wt. which drove the Brigantine on shore in the entrance of the Harbour must infalibly have drove all the Vessels on shore in the Bay, where they must have gone to peices, and the People either drown'd or fallen into the hands of the French Indians.

After the Brigantine was on shore, the Officers & Crews of all the Vessels (the whole not exceeding one hundred) were enployed in getting her off and refitting her with all the expedition we Could; except a Schooner Tender which I kept manned and employed cruizing to the Eastward and Westward of the Harbours Mouth, by Collonel Mercer's desire, and under his directions, that the Garrison might not be surprized,

Their Lordships will see by the above mentioned paragraph that the Marquis of Montcalm was on his way (from the Intelligence Collonel Mercer recieved) before the Vessels went into the Harbour, though had we been out we could not have prevented their coming; the Enemy having taken precaution not to Cross the lake; but to Coast with their Batteaus close to the shoar round the bottom of it; where we could not have come/near them; and landed in the night in a place where it's impossible to have kept Vessels cruising upon them close in shore, on Account of the Bay being very small and a great deal of foul ground in it;

I beg leave to observe to their Lordships that the Intelligence which Collonel Mercer recieved about the Batteaus being on their way before the Vessels came into the Harbour (which shews the Marquis of Montcalm did not wait their returne from their Cruize) contradicts what is asserted in the latter paragraph which says that the Marquis of Montcalm declared that he took that Opportunity of Transporting & landing his Troops, and Artillery which Otherwise he should not have done; I don't believe the Marquis of Montcalm ever made such a declaration; I don't understand French myself, but I never heard from Captain Laforey who does, and conversed with the Marquis of Montcalm, and Marquis of Vaudriel often, nor from any of our Officers taken at that place who understood French, that he did so; so far from it, so little did they apprehend from our Vessels, that they did not think their's which they knew to be superior to ours, necessary to cover their landing, nor did they come till after the place was taken; and that only to Transport the Guns, Amunition &c., to cataraqui; having no more Men in them then was Necessary to work them; it is a concern to me that what few I saved relative to that affair

are not at this instant in my possession, being among my Baggage which is coming to this place by water; which prevents my being so circumstantial as I should otherwise be; but in case there is anything remaining which their Lordships would please to be informed of, I can venture to promise to account for every particular part of my Conduct in that affair; as I never took the least step without the Opinion and Concurrance of the Commanding Officer (According to my Orders) nor did any thing of greater consequence without the Opinion of a Council of Warr.

In case their Lordships are not fully satisfied with the Account I have given of my Conduct in relation to the above mentioned paragraphs; I hope they will be pleased to permit me and Captain Laforey to come to London to vindicate ourselves before their Lordships, in presence of the Author of them; as I can offer other circumstances when I get my papers, to corroborate what I have now laid before them.

I am,
Sir
Your most Obedient
Humble Servant
HOUSMAN BROADLEY.

JOHN CLEVLAND ESQR Secretary of the Admiralty.

Adm: Sec. Out Letters. Vol. 706 p. 405.

19 Janry. 1757.

Sir,

My Lords Commrs. of the Admiralty having seen a Representation of the State of the Garrison, Work & Naval Force at Oswego, at the time of its being attacked by the French, in which are Two Paragraphs which seem to be a Charge upon you & the Commanding Officers of Two Vessels employed under you, I am commanded by their Lordships to send you the enclosed Copy of the same, & to signify their directions that you give them a particular & circumstantial Account of your Proceedings, as well as those of the other two Vessels at the time therein mentioned,

I am
J.C.
Copy.

CAPT. BROADLEY, Deal.

Inclosed Copy of a Representation of the State of the Garrison Work & Naval Force at Oswego when attacked by the French in which seems to be a Charge against him & the Commdrs. of the Two Vessels employed under him—To give a particular Acct. of his Proceedings on that Occasion.

Mémoires de la Société Royale du Canada
SECTION I

Série III DÉCEMBRE 1914 Vol. VIII

Les premières concessions de terre à Montréal, sous M. de Maisonneuve.
1648-1665.

Par E. Z. Massicotte.

Présenté par B. Sulte, F.R.S.C.

(Lu le 26 mai 1914)

Au cours de nos recherches, nous avons pu rassembler les actes de concessions dressés par M. de Maisonneuve et qui se trouvent au palais de justice de Montréal.

Dans le même temps, on nous a communiqué le relevé que les archivistes du Dominion ont fait des documents du séminaire de Saint-Sulpice et, de ces deux sources, nous avons formé la série à peu près complète des actes qui établissent à qui et comment furent concédées les premières terres de Montréal.

Grâce à ces pièces, il nous est permis de suivre dans son détail le développement de la colonisation sur cette île favorisée qui est devenue l'un des points importants du Canada.

* * *

De retour, à l'été de 1647, après un assez long séjour en France, où il avait été en contact avec les membres de la société de Montréal, M. de Maisonneuve apportait l'ordre[1] de faire cesser l'inaction dans laquelle vivait, depuis cinq ans, la nouvelle colonie et c'est au début de 1648 que le fondateur de Montréal commence la distribution des terres de son gouvernement.

Les terres distribuées se trouvent dans les localités suivantes: au nord du fort de Villemarie; à l'ouest, c'est-à-dire à la Pointe Saint-Charles, à la contrée Saint-Joseph et à la rivière Saint-Pierre; au nord et au nord-est, le long de la rivière Saint-Martin; au-dessous du coteau Saint-Louis, vers la terre Sainte-Marie et la côte Saint-Martin.

[1] C'est l'expression dont il se sert dans le premier acte de concession que nous citons plus loin.

C'est M. de Maisonneuve qui concède au nom de la société de Montréal et il rédige chaque acte lui-même.

Pour constituer le contrat le concessionnaire accepte quelquefois la concession par devant notaire, mais la plupart du temps il se contente de l'acte pur et simple.

La formule dont se sert M. de Maisonneuve débute ainsi dans le premier document:

"Nous, Paul de Chomedy Escuyer, Sieur de Maisonneuve, gouverneur de l'isle de Montréal et terres qui en despendent soubsigné, suyvant les ordres que nous avons reçeus de Messieurs les Associés pour la conversion des Sauvages de la Nouvelle France en laditte Isle de Montréal et Seigneurs d'Icelle, afin de donner et despartir les terres et héritages contenus en laditte Isle à ceux lesquels auroient affection de sy establir et y faire leur demeure ordinaire afin par ce moyen de procurer l'estendue de la foy dans le pays, suyvant la prière qui nous a esté faitte pat Pierre Gadoys"...etc.

Dans le deuxième acte, il remplace "les ordres que nous avons receus" par "les pouvoirs et commissions à nous donnés."

A partir de 1650, il condense de beaucoup son préambule, car il n'en reste plus que ceci:

"Paul de Chomedey, gouverneur de Lisle de Montréal, en la Nouvelle France et terres qui en despendent, suivant les pouvoirs et commissions qui nous ont esté donnés par Messieurs les associés pour la conversion des Sauvages de la Nouvelle France, en ladite Isle, nous avons donné et concédé, donnons et conceddons à ...."

Il arrive encore que M. de Maisonneuve fasse ses concessions dans un contrat de mariage; il apparait alors, dirait-on, comme un parent fortuné ou un protecteur des futurs époux. Cette façon de procéder laisse supposer qu'il se faisait de ses fonctions une conception toute paternelle.

Ainsi, il avantage lors de leurs seconds mariages, Roberte Gadois dont l'hymen avec César Léger avait été annulé, et encore, Anne Archambault qui, d'abord, avait épousé un bigame, etc. D'autres fois, au mariage d'une veuve, il intervient pour obliger le futur à élever et nourrir les enfants du premier lit jusqu'à un certain âge, s'il veut jouir de la terre de son prédecesseur.

La lecture des diverses pièces dont nous nous occupons, nous dévoile que M. de Maisonneuve laissait des colons prendre possession de certaines terres sans dresser d'acte; il se bornait, dans ce cas, à leur promettre, verbalement ou par écrit, qu'il leur ferait une concession. Il agissait ainsi, croit-on, pour s'assurer que le colon était de bonne fois ou afin de le forcer à défricher un espace déterminé avant de lui remettre un titre.

La superficie des terres concédées est généralement de trente arpents, mais la plupart des premiers colons augmentèrent, par la suite, cette superficie d'un tiers et du double.

Le prix de vente ne varie pas. Les terres se concèdent à raison de trois deniers (c'est-à-dire un liard) de censive par arpent; quant aux emplacements de ville, le prix est de cinq sols (60 deniers) par arpent. Le tout payable annuellement.

En plus, le concessionnaire, s'il a des animaux, doit payer 5 sols de droit de commune, il s'engage à bâtir maison ou à défricher et il est sujet aux autres droits seigneuriaux stipulés dans la coutume de Paris.

* * *

Tant que M. de Maisonneuve fut gouverneur, nul autre ne concéda que lui et le nombre de ses actes connus s'élève à 123; cependant, il est évident qu'il nous en manque quelques uns qui seront retrouvés soit au long, soit en mention dans d'autres pièces.

Après le départ définitif pour la France, du fondateur de Montréal, ce sont les Supérieurs du Séminaire qui font les concessions, sous seing privé d'abord et, finalement, devant notaire.

* * *

Les manuscrits de M. de Maisonneuve sont d'une lecture relativement facile. En cela il l'emporte sur tous ses contemporains. Son écriture est corpulente, régulière et simple; de plus, contrairement à la coutume adoptée par la plupart des scribes du dix-septième siècle il n'emploie aucune abréviation.

A l'exception d'une couple de fois, M. de Maisonneuve signe toujours Paul de Chomedey.

* * *

Le répertoire qui va suivre nous démontre qu'au début les colons manquaient d'enthousiasme. De 1648 à 1653, six individus seulement ont obtenu des terres. D'autres cependant, avaient faits des défrichements, mais n'avaient pas encore de titre écrit.

C'est à partir de 1654 que les concessions se donnent en nombre suffisant pour permettre d'espérer que l'île de Montréal serait enfin habitée d'une manière permanente.

Nous avons essayé, dans le répertoire que ces notes précèdent, de fournir, sous une forme brève, assez de renseignements pour que notre modeste travail puisse être de quelque utilité aux historiens.

1648.

4 janvier—Concession à Pierre Gadoys.

Quantité et localité: 40 arpents . . . "le premier pieu d'alignement étant planté à 23 perches du milieu du pont basty sur pilotis proche du fort . . . sur la petite rivière joignant le fort."

Au pied de l'acte: Acceptation de ladite concession par devant le notaire Jean de Saint-Père.
Nota: Cette pièce est le plus ancien acte de concession ainsi que le plus ancien acte notarié qui se trouve au palais de justice de Montréal. C'est aussi le premier acte mentionné dans le registre du tabellionnage de Montréal dressé par Basset en 1674.

10 janvier—Concession à Jean Desroches.
Quantité et localité: 30 arpents . . . "commençant 20 perches de face, proche le lieu destiné pour la ville."
Voisins: Augustin Hébert et Urbain Tessier.

13 janvier—Concession à Simon Richomme.
Quantité et localité: 30 arpents . . . "commençant 20 perches proche de la petite rivière . . . tirant vers la montagne."
Voisins: Blaise Juillet et Léonard Lucault.

1649.

Aucune concession.

1650.

30 mars—Concession à Blaise Juillet dit Avignon.
Quantité et localité: 30 arpents . . . "commençant 20 perches sur le bord des communes de Villemarie."
Voisins: Gilbert Barbier et Simon Richomme.

22 octobre—Dans le contrat de mariage de Louis Prudhomme et Roberte Gadois, devant Jean de Saint-Père, M. de Maisonneuve accorde une concession aux futurs.

7 novembre—Concession à Gilbert Barbier.
Quantité et localité: 15 arpents, près de la commune et 40 arpents, en un lieu commode . . .
Voisins de la terre de 15 arp.: Louis Prudhomme et Blaise Juillet.

8 novembre—Concession à Jean Descarris.
Quantité et localité: 30 arpents dans la contrée Saint-Joseph et un arpent dans l'enclos de la ville.
Voisins de la terre: Henri Perrin et Antoine Primot.

1651.

18 septembre—Concession à Urbain Tessier dit la Vigne.
Quantité et localité: 30 arpents, proche le lieu destiné pour la ville.
Voisins: Jean Desroches et Jacques Archambault.

18 septembre—Concession à Jacques Archambault.
Quantité et localité: 30 arpents . . . sur le bord des fonds . . . joignant les terres réservées pour la ville.
Voisins: Urbain Tessier et Lambert Closse.
Nota:—C'est d'après cet acte que nous avons placé dans notre liste des Colons, parue l'année dernière dans ces mémoires, l'arrivée d'Archambault, à Montréal en 1651. D'autres documents nous ont démontré, depuis, que

cela est inexact. Trois jours plus tôt, le 15 septembre 1651, J. Archambault avait reçu une concession à Québec et il ne pouvait être à Montréal, le 18. D'ailleurs, en examinant l'acte attentivement, on constate que la date est d'une autre encre et a dû être ajoutée plus tard. Voir notre étude sur ce point dans le Bulletin des Rech. Hist., 1914, p. 316.

23 septembre—Concession à Nicolas Godé.
Quantité et localité: 30 arpents au lieu dit la Grande Anse, commençant 20 perches le long du domaine réservé pour les seigneurs.
Voisins: Jean de Saint-Père et Jean Millot.

2 octobre—Contrat de commune à Jean de Saint-Père, syndic, en faveur des habitants de Montréal.
Quantité et localité: 40 arpents . . . "le long de la grande et la petite rivière qui passe joignant le fort."

1652.

Aucune concession. M. de Maisonneuve est en France.

1653.

23 décembre—Acte de mise en possession à Jean de Saint-Père, d'une terre mentionnée dans son contrat de mariage.
Quantité et localité: 40 arpents . . . "proche la grande rivière, au coin de l'embouchure d'un petit ruisseau . . . au lieu dit la Grande Anse . . . près de la prairie Saint-Pierre.

29 décembre—Dans le contrat de mariage de Jean Milot par devant Lambert Closse, M. de Maisonneuve donne une terre aux futurs époux ainsi qu'un emplacement.
Quantité et localité: 30 arpents . . . à la prairie Saint-Pierre et un arpent au lieu destiné pour la ville.
Voisin de la terre: Nicolas Godé.

1654.

17 janvier—Concession à Jacques Beauvais dit Saint-Jemme.
Quantité et localité: 30 arpents . . . dans la contrée Saint-Joseph.
Voisins: Louis Prudhomme et Henri Perrin.

17 janvier—Concession à Eloi Jarry dit la Haye et Henri Perrin.
Quantité et localité: 30 arpents dans la contrée Saint-Joseph.
Voisins: Jacques Beauvais et Jean Descarris.

23 janvier—Concession d'emplacement à Nicolas Godé.
Quantité et localité: 2 arpents . . . "dans le lieu destiné pour la ville et où il a fait bâtir maison . . . "

24 janvier—Concession à Jacques Picot dit Labrie et Jean Aubuchon dit Lespérance.
Quantité et localité: 30 arpents "proche du lieu destiné pour la ville et un arpent dans ladite ville."
Voisin de la terre: Simon Després.

24 janvier—Concession à Sébastien Audiot dit Laflesche.
Quantité et localité: 30 arpents proche du lieu destiné pour la ville et un arpent dans la ville.
Voisins de la terre: Jean Aubuchon et Estienne Bouchard.

2 février—Concession à Pierre Gaudin, charpentier.
Quantité et localité: 30 arpents, au dessous du coteau Saint-Louis.
Voisin: René Bondy.

2 février—Concession à Marin Jannot.
Quantité et localité: 30 arpents au dessous du coteau Saint-Louis.
Voisin: Pierre Gaudin.

12 février—Concession à Gabriel Le Selle.
Au pied: Acceptation devant Lambert Closse.
Quantité et localité: 30 arpents, proche du fort, sur le bord de la commune.
Voisin: Simon Richomme.

23 juillet—Concession à Simon Desprès.
Quantité et localité: 30 arpents, "proche le coteau Saint-Louis et du côté qu regarde la montagne."
Voisins: Jacques Picot et Jean Aubuchon.
Nota: Cette terre passe à Jean Auger, en 1656.

23 juillet—Concession de terres à Charles LeMoyne.
Quantité et localité: 90 arpents . . . "la terre appelée la Pointe Saint-Charles, proche la Grande Anse," plus un arpent "dans l'enclos de la ville, proche de l'hôpital, sur lequel il a fait bâtir maison."
Nota: Le concessionnaire s'oblige à donner la jouissance de la moitié de la terre à Antoine Primot et sa femme, beaux-parents de Lemoyne.

24 juillet—Concession à Toussaint Hunault.
Quantité et localité: 30 arpents . . . proche le coteau Saint-Louis.
Voisin: Jean Lemerché dit Laroche.

24 juillet—Concession à Jean Lemerché.
Quantité et localité: 30 arpents . . . "au dessous du coteau Saint-Louis."
Voisins: Toussaint Hunault et Mathurin Langevin dit le petit LaCroix.

24 juillet—Concession à Mathurin Langevin dit LaCroix.
Quantité et localité: 30 arpents . . . audessous du coteau Saint-Louis.
Voisins: Jean Lemercher et Louis Loisel.

24 juillet—Concession à Simon Galbrun.
Quantité et localité: 30 arpents . . . audessous du coteau Saint-Louis.
Voisins: Louis Loisel et Gilles Bastard.

24 juillet—Concession à Bertrand de Rennes.
Quantité et localité: 30 arpents . . . proche le coteau Saint-Louis.
Voisin: Simon Després.

8 août—Donation de la moitié de la métairie à l'Hôtel-Dieu, plus 1100 livres pour que Mlle Mance établisse son domicile à Montréal.
NOTA: Cette pièce est au séminaire.

24 octobre—Concession à Robert Le Cavelier dit Deslauriers, à la charge de nourrir les enfants de feu Augustin Hébert dit Jolycœur.
Quantité et localité: 40 arpents . . . proche de Villemarie à 15 perches de la petite rivière joignant le fort."
Voisins: Pierre Gadois et Jean Desroches.

1655.

26 janvier—Concession à Jean Milot, taillandier.
Quantité et localité: Un demi-arpent avec maison proche le fort.
En marge: 11 décembre 1661—Autre concession de demi-arpent joignant l'emplacement ci-dessus.

30 mars—Concession à Jean Gervaise.
Quantité et localité: 30 arpents audessous le coteau Saint-Louis.
Voisin: Marin Jannot.

7 avril—Concession à André Charly.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisin: Jean Gervaise.

10 avril—Concession à Jean Desroches.
Quantité et localité: 30 arpents proche le lieu destiné pour la ville et un arpent dans l'enclos de la ville, sur le bord de la commune.
Voisins de la terre: Robert le Cavelier et Urbain Tessier.
Voisins de l'emplacement: Nicolas Godé et Jean Milot.
Nota: Une clause de l'acte se lit ainsi: "pour ce qui est de la terre que ledit Desroches a défriché depuis le haut de la côte jusques au bas, elle ne pourra lui être ôtée qu'en lui payant 200 livres l'arpent."
En 1667, sa concession du 10 avril est passée au sieur de Robutel.

20 août—Concession à Toussaint Hunault.
Nota: Au séminaire.

20 août—Concession à Louis Loisel.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Mathurin Langevin et Simon Galbrun.

20 août—Concession à Pierre Chauvin.
Quantité et localité: 30 arpents, proche le coteau Saint-Louis.
Voisins: Toussaint Hunault et Jacques Mousseaux.

20 août—Concession à Gilles Lauson.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis et un arpent dans l'enclos de la ville.
Voisins de la terre: André Charly.
Voisin de l'emplacement: Jacques Archambault.

20 août—Concession à Jean Leduc.
Quantité et localité: 30 arpents à la contrée Saint-Joseph et un arpent dans l'enclos de la ville, sur lequel Leduc a fait bâtir maison, ledit arpent lui ayant été promis auparavant.
Voisins de la terre: Jean Grimart et Marin Heurtebise.

20 août—Concession à Marin et André Heurtebise.
Quantité et localité: 30 arpents, dans la contrée Saint-Joseph.
Voisins: Jean Leduc et Jean Descarris.
Nota: "A charge de satisfaire Charles Lemoyne, Messier et Antoine Primot pour défrichage fait sur la dite terre."

20 août—Concession à André Dumay.
Quantité et localité: Un arpent avec une maison et 15 arpents tirant vers la rivière Saint-Pierre
Voisin: Jean Chappeleau.

20 août—Concession à Jean Dumay.
Nota: Au séminaire.

20 août—Concession à Nicolas Hubert dit LaCroix.
Quantité et localité: 15 arpents, audessous du coteau Saint-Louis et un demi-arpent dans la ville.
Voisin de la terre: Gilles Lauson.
Voisins de l'emplacement: Jean Simon et André Charly.

30 août—Concession à André Charly dit St-Ange.
Quantité et localité: Un demi arpent dans l'enclos de la ville.
Voisins: Jean Chappeleáu et Nicolas Hubert dit Lacroix.

31 août—Concession à Jean Simon.
Quantité et localité: Un demi arpent dans l'enclos de la ville.

31 août—Concession à Jacques de Laporte.
Quantité et localité: Un demi arpent dans l'enclos de la ville.

31 août—Concession à Jean Gervaise.
Quantité et localité: Un demi arpent dans l'enclos de la ville.

1656.

10 décembre—Concession à Louis Guerestin.
Quantité et localité: 30 arpents, "au lieu de *lance fondue*."
Voisins: Nicolas Hubert et Christophe Gaillard.
M. de Maisonneuve étant alors en France comment expliquer cette date?
Le manuscrit est bien de l'écriture de M. de Maisonneuve, mais les mots qui suivent mil, soit "six cent cinquante-six" ont visiblement été ajoutés plus tard et l'on a du se tromper d'année ou bien l'on avait des raisons pour que l'acte porte cette date.

1657.

Aucune concession—M. de Maisonneuve revient de France à la fin de l'été.

1658.

22 janvier—Donation au nom des Associés de Montréal, d'un bâtiment de pierre de 36 pieds x 18 pieds, proche l'hôpital avec terrain de 48 perches pour servir à l'instruction des filles de Montréal.
Nota: Pièce disparue—Citée par Faillon, II, 285, d'après les archives de l'Hôtel-Dieu et de la Congrégation Notre-Dame.

27 janvier—Concession à Nicolas Millet dit le Beauceron.
Quantité et localité: 20 arpents, du côté de la rivière Saint-Pierre.
Voisins: André Demers, Jean Millot et Veuve Godé.

27 janvier—Concession à la veuve de Nicolas Godé.
Quantité et localité: 10 arpents, du côté de la rivière Saint-Pierre, sur laquelle terre Jean Chappeleau a fait quelque travail.
Voisins: André Demers, Jean Milot et Nicolas Milet.

2 février—Concession de fief à Lambert Closse.
Quantité et localité: 100 arpents, commençant à 10 perches de la grande rivière, sur 40 perches de large.
Voisins: Jacques Archambault et Etienne Bouchard.

1659.

8 mai—Concession à Guillaume Estienne.
Quantité et localité: 30 arpents, à la contrée Saint-Joseph.
Voisins: Mathurin Jouanneau et Honoré Dansny.

9 mai—Concession à Mathurin Jouanneau.
Quantité et localité: 15 arpents à la contrée Saint-Joseph.
Voisins: Simon LeRoy et Guillaume Estienne.

9 mai—Concession à Honoré Dansny dit le Tourangeau.
Nota: Pièce disparue. Citée dans Basset, 17 juin 1664.

10 mai—Concession à Jacques Testard.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Laurent Archambault et Paul Benoist.

10 mai—Concession à Simon Le Roy.
Quantité et localité: 30 arpents à la contrée Saint-Joseph.
Voisin: Mathurin Jouanneau.

10 mai—Concession à Silvestre Vacher dit Saint-Julien, charpentier.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Paul Benoit et Jean Valliquet dit Laverdure.
Nota: Cette terre passe à Dollard Desormeaux, puis à Pierre Picoté de Belestre. Voir notre étude dans l'*Antiquarian* de 1912, p. 52.

12 mai—Concession à Michel Théodore.
Quantité et localité: 15 arpents à la contrée Saint-Joseph.
Voisin: Michel Louvard, meunier.

12 mai—Concession à Léger Haguenier.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Simon Galbrun et Pierre Godin dit Chatillon.

12 mai—Concession à Laurent Archambault.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Urbain Geté et Jacques Testard dit Laforest.

12 mai—Concession à François Roisnet.
Quantité et localité: 30 arpents à la contrée Saint-Joseph.
Voisins: Honoré Dansny et Michel Louvard.

12 mai—Concession à Paul Benoist, charpentier.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisins: Jacques Testard et Silvestre Vacher.

12 mai—Concession à Christophe Gaillard dit le prieur.[1]
Quantité et localité: 15 arpents, audessous du coteau Saint-Louis.
Voisins: Louis Guerestin et Urbain Geté.

12 mai—Concession à Michel Louvard, meunier.
Quantité et localité: 15 arpents, à la contrée Saint-Joseph.
Voisins: Francois Roisnay et Michel Théodore dit Gilles.

15 mai—Concession à Jacques de la Porte dit Saint-Georges.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis "tenant d'un côté à une route faite depuis le bord de la rivière jusqu'au commencement du lieu appelé le lac ou prairie aux scieux (?)".

15 mai—Concession à Jean Valliquet dit Laverdure.
Quantité et localité: 22 arpents et ½ audessous du coteau Saint-Louis.
Voisins: Silvestre Vacher et Jacques de la Porte.

23 décembre—Concessions aux RR. MM. Hospitalières.
Quantité et localité: 100 arpents au lac à la loutre.
Voisin: Fiacre Ducharme dit Lafontaine.

1660.

3 mai—Concession à Michel Guibert.
Quantité et localité: 30 arpents, audessous de la rivière Saint-Pierre.

22 août—Concession à Jacques LeBer et Charles Lemoyne.
Quantité et localité: Une pièce de terre de 76 pieds x 60 pieds, proche l'hôpital Saint-Joseph, sur laquelle les dits LeBer et Lemoyne ont fait bâtir une maison de 36 pieds x 23 pieds.
Voisin: Jacques Testard.

27 août—Concession à Jacques Testard dit Laforest.
Quantité et localité: Une pièce de terre de 47 pieds x 60 pieds, sur laquelle ledit Testard a fait bâtir une maison de 22 pieds x 16 pieds.
Voisins: Jacques LeBer et Charles Lemoyne.

[1]Nous avons écrit *le prime* dans notre liste des colons, No. 298, mais nous croyons que c'est une erreur et que *le prieur* est plus exact.

23 novembre—Mise en possession de 200 arpents de terre au profit de l'Hôtel-Dieu de Villemarie.
Quantité et localité: 200 arpents au "lac au Loutre."
Voisins: Les RR. MM. Hospitalières.
Ensemble: Concession du 8 mars 1650, signée par Louis Séguier à Paris, par laquelle la Société de Montréal donne 200 arpents de terre à choisir plus tard.

1661.

2 mai—Concession à Pierre Picoté de Belestre.
Quantité et localité: 30 arpents . . . "tirant vers Sainte-Marie."
Voisins: Jean Valliquet et Paul Benoit.
Nota: Cette terre avait déjà été concédée à Silvestre Vacher le 10 mai 1659, puis elle était passée à Adam Dollard.

3 décembre 1661—Concession à Jacques LeBer.
Quantité et localité: 20 arpents à la prairie Saint-Pierre.
Voisins: Héritiers de Jean de Saint-Père et de Nicolas Godé.

1662.

10 août—Concession à Urbain Geté.
Quantité et localité: 15 arpents au lieu dit Sainte-Marie.
Voisins: Christophe Gaillard et Laurent Archambault.

16 août—Donation pour l'emplacement de l'église.
Quantité et localité: Une pièce de terre joignant la commune d'un côté, la terre de feu Nicolas Godé d'autre côté . . . d'un bout la terre de MM. les prêtres et d'autre le chemin qui passe le long de la concession du Sieur Robutel de St. André, avec 4 arpents y attenant.
Ce lopin de terre comprenait 2 arpents ci-devant accordé à feu Nicolas Godé, un arpent à Nicolas Godé fils et un arpent à feu Jean de St-Père, à la charge par les marguilliers de payer 200 livres par arpents aux propriétaires ainsi que les bâtiments sus érigés.

20 août—Concession à Guillaume Chartier de 6 arpents de terre . . . Mentionnée dans l'acte de concession que fait M. l'abbé Souart au même, le 5 février 1667.

25 août—Concession à Louis Prudhomme.
Quantité et localité: 12 arpents du côté de la montagne . . . attenant à sa précédente concession.

25 août—Concession à Marin de Niau dit Destallys, d'une terre ayant appartenue à Mme Dailleboust.
Quantité et localité: 30 arpents, à la rivière Saint-Pierre.
Voisins: La Louaire et les terres de St-Gabriel.

25 août—Concession à Benigne Basset.
Quantité et localité: 30 arpents près la ville et 25 perches dans l'enclos de la ville au lieu où il a fait bâtir maison.
Voisin de la terre: Jean Desroches.
Voisin de l'emplacement: Jean Gervaise.

25 août—Concession à Louis Chevallier.
Quantité et localité: 12 arpents, à la contrée Saint-Joseph.
Voisin: Jean Descarris.

25 août—Concession à Jean Gasteau.
Quantité et localité: 12 arpents à la contrée Saint-Joseph.
Voisin: Jean Leduc.

25 août—Concession à Jean Auger dit Baron.
Quantité et localité: 30 arpents au bout de la concession d'Urbain Tessier.

25 août—Concession à Pierre Peras dit La fontaine, tonnelier.
Quantité et localité: 24 arpents sur le bord de la prairie Saint-Pierre.
Voisins: Pierre Malet et Jacques Beauchamp.

25 août—Concession à Jacques Beauchamp.
Quantité et localité: Dix perches de large jusqu'aux terres ci-devant concédées.
Voisins: Pierre Péras et Estienne Laire.

25 août—Concession à Guillaume Chartier.
Quantité et localité: 6 arpents à la contrée Saint-Joseph.
Voisin: Mathurin Jouanneau.

25 août—Concession à Olivier Charbonneau.
Quantité et localité: 12 arpents, à la contrée Saint-Joseph.
Voisin: Honoré Dasny.

25 août—Concession à Mathurin Lorrion.
Quantité et localité: 12 arpents à la contrée Saint-Joseph.
Voisin: Simon LeRoy.

25 août—Concession à Jean Leduc.
Quantité et localité: 12 arpents à la contrée Saint-Joseph, joignant sa précédente concession.

25 août—Concession à Estienne Laire.
Quantité et localité: 10 perches de larges jusqu'aux terres ci-devant concédées, sur le bord de la rivière Saint-Pierre.
Voisins: Jacques Beauchamp et Guillaume Gendron.

25 août—Concession à Pierre Malet.
Quantité et localité: 10 perches de large jusqu'aux terres ci-devant concédées sur le bord de la rivière Saint-Pierre et joignant les terres de Saint-Gabriel.

25 août—Concession à Gilbert Barbier.
Quantité et localité: 6 arpents du côté de la montagne, joignant une terre lui appartenant.

25 août—Concession à François Bailly dit Lafleur, maçon.
Quantité et localité: 30 arpents au bout de la terre de Jacques Archambault.

25 août—Concession à Claude Robutel de Saint-André.
Quantité et localité: 24 arpents.
Voisins: Gabriel le Sel dit Duclos et Pierre Richomme.

4 septembre—Concession à Pierre Lorrain.
Quantité et localité: 12 arpents à la contrée Saint-Joseph.
Voisin: Henri Perrin.

4 septembre—Concession à Mathurin Thibaudeau.
Quantité et localité: 12 arpents à la contrée Saint-Joseph.
Voisin: Guillaume Estienne.

26 septembre—Concession à Claude Robutel de Saint-André.
Quantité et localité: 1 perche de large le long de la terre qui lui a été précédemment concédée.

31 octobre—Concession à Marguerite Bourgeois.
Quantité et localité: 60 arpents vers le lac Saint-Joseph (lac la Loutre ?).
Voisins: RR. MM. Hospitalières et Michel Théodore dit Gilles, François Roisnet et Michel Louvart dit Desjardins.

31 octobre—Concession à Fiacre Ducharne dit Lafontaine.
Quantité et localité: 20 perches de large, à la prairie Saint-Pierre.
Voisins: Jean Milot, Jacques LeBer et Marguerite Bourgeois.

21 décembre—Mise en possession, par le Gouverneur d'une terre concédée à Charles D'Ailleboust par mandement de la Société de Montréal, en date du 30 mars 1653.
Quantité et localité: 100 arpents comme suit: 2 arpents x 29 joignant et au bout des concessions de Jean Aubuchon et Jacques Picot; plus, un arpent x 14, au bout de la concession de Sébastien Audiot; 1 arpent x 14 au bout de la concession de Gilles Lauson, et 1 arpent x 14 au bout de celle de Honoré Langlois.

1663.

Aucune concession. Conflit entre le Conseil Souverain et les seigneurs de Montréal.

1664.

12 janvier—Concession à Mathurin Goyer dit la Violette.
Nota: Cette pièce est au Séminaire.

23 janvier—Concession à Charles LeMoyne.
Quantité et localité: Morceau de terre joignant l'emplacement qu'il possède déjà, pour lui permettre d'allonger sa maison de 23 pieds.

19 mai—Concession à Dame Catherine Gauchet.
Nota: Cette pièce est au Séminaire.

4 juin—Concession à André Charly.
Quantité et localité: 30 arpents joignant la terre lui appartenant.

13 juin—Concession à Jean Baudouin.
Quantité et localité: 30 arpents, audessous du coteau Saint-Louis.
Voisin: Jean Gervaise.

1665.

4 mars—Concession à Claude Fézeret.
Quantité et localité: 36 pieds en carré sur le bord de la commune, pour bâtir maison.
Voisines: Les Filles de la Congrégation.
Nota: Le 15 février 1666, Marguerite Bourgeois cède gratuitement, à la veuve Fézeret, 2 pieds x ½ pied de terre sur 36 de largeur pour parachever le 36 pieds en carré.

2 avril—Concession à Antoine Courtemanche dit Jollycœur.
Quantité et localité: 30 arpents au lieu nommé Saint-Martin, audessous du premier ruisseau.

3 avril—Concession à Antoine Baudry dit Lespinette.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisin: Antoine Courtemanche.

4 avril—Concession à Pierre Lorrin dit Lachapelle.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisin: Antoine Baudry.

5 avril—Concession à Jean Mée dit du Meslier.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisin: Pierre Lorrin.

6 avril—Concession à Nicolas Giar.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisin: Jean Mée.

1 mai—Concession à Simon Cardinal.
Quantité et localité: 30 arpents, au dessus de la rivière Saint-Pierre.

2 mai—Concession à Suzanne Guillebaut, veuve de Claude Fézeret.
Quantité et localité: 30 arpents, au lieu dit Saint-Martin.
Voisin: Jacques Mousseaux.

2 mai—Concession à Estienne Campot.
Quantité et localité: 30 arpents audessus de la rivière Saint-Pierre.
Voisin: Simon Cardinal.

2 mai—Concession à Jean Roy.
Quantité et localité: 30 arpents, audessus de la rivière Saint-Pierre.
Voisins: Etienne Campot et Pierre Gadoys fils.

3 mai—Concession à Pierre Desotels dit Lapointe.
Quantité et localité: 30 arpents au lieu nommé Saint-Martin.
Voisins: Suzanne Guillebaut, veuve Fézeret et René Fézeret, son fils.

3 mai—Concession à Jacques Mouceaux dit Laviolette.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisins: Suzanne Guillebaut, veuve Fézeret et René Fézeret son fils.

3 mai—Concession à Elie Joseph Beaujean.
Quantité et localité: 30 arpents, au lieu nommé Saint-Martin.
Voisin: Estienne Hardouin.

3 mai—Concession à Jean Chicot.
Quantité et localité: 2 arpents de large, proche la rivière Saint-Pierre jusqu'aux terres ci-devant concédées, plus 4 arpents joignant ladite concession.
Voisin: Estienne Lair.

3 mai—Concession à Pierre Caille dit Larochelle.
Quantité et localité: 44 pieds x 35 pieds, dans la ville.
Voisins: Jean Gervaise et Mme Dailleboust.

3 mai—Concession à Michel Guibert.
Quantité et localité: 30 arpents, audessus de la rivière Saint-Pierre.
Voisin: Pierre Gadois fils.

9 mai—Concession à Pierre Perusseau.
Quantité et localité: 30 arpents au-dessus de la rivière Saint-Pierre.
Voisin: Gabriel LeSel dit LeClos.
Nota: Mentionné dans un acte de Basset, du 13 février 1668.

France et Canada: Dieppe-Québec (1639); Québec-Dieppe (1912).

PAR M. L'ABBÉ AUGUSTE GOSSELIN.

(Lu le 28 mai 1914).

I

Que ne devons-nous pas, nous Canadiens, à la France, notre ancienne mère patrie? Pour ne parler que des choses religieuses, n'est-ce pas de la France que nous tenons cet esprit évangélisateur qui anime nos missionnaires, nos religieuses, et inspire aux uns et aux autres la volonté et le courage de s'expatrier et de quitter tout ce qu'ils ont de plus cher au monde pour aller étendre au loin le règne de Dieu, dans les pays étrangers, et jusque chez les nations infidèles de la terre inhospitalière de l'Afrique, où nous comptons déjà tant d'apôtres Canadiens?[1]

Mais qui aurait cru que nous aurions jamais occasion de rendre à la France, en fait d'apostolat, quelque chose de ce qu'elle fit autrefois pour nous? *Dieppe-Québec* (*1639*), *Québec-Dieppe* (*1912*): ce titre que nous mettons en tête de ce mémoire en indique tout de suite le sujet: un épisode de réciprocité de services entre Dieppe et Québec, entre le Canada et la France: épisode qui ne nous a pas paru indigne d'occuper quelques instants l'attention de nos bienveillants confrères de la Société Royale.

Tout le monde sait que l'Hôtel-Dieu de Québec, le plus ancien de nos hôpitaux, qui rendit autrefois tant de services à la colonie, et qui est encore une de nos principales institutions hospitalières, une de celles qui ont toujours su se tenir au courant de tous les progrès en médecine et en chirurgie, doit son origine à celui de Dieppe. Il fut fondé en 1637 par la duchesse d'Aiguillon, nièce du cardinal de Richelieu: le contrat de fondation "fut passé le 16 août, en l'hôtel de la duchesse, à Saint-Germain-des-Prés-lez-Paris[2]." Richelieu

[1] "En Afrique, il y a, exactement, 34 Pères Blancs canadiens, et 47 Sœurs Blanches canadiennes, dont onze qui sont encore novices. En tout, 81 des nôtres! . . . En septembre prochain, quatre jeunes gens partiront pour notre noviciat, qui est à Maison-Carrée, près d'Alger, et vers le même temps une douzaine de postulantes s'embarqueront aussi pour se rendre au noviciat . . " (Lettre du R. P. Forbes à l'auteur, Québec, 37. Rue des Remparts, 25 mai 1914.)

[2] Archives de l'Hôtel-Dieu de Québec.

avait fondé dix ans auparavant la compagnie des Cent-Associés[1], destinée à coloniser la Nouvelle-France: la duchesse d'Aiguillon, entraînée par la générosité de sa nature bienveillante, non moins que par les récits des missionnaires jésuites, qui, dans leurs *Relations*[2], faisaient voir la nécessité d'un hôpital à Québec pour le soulagement des misères corporelles tout à la fois des colons français et des sauvages, résolut de fonder cet hôpital; et dès l'année suivante (1638), ayant obtenu de la compagnie des Cent-Associés, outre un terrain pour l'hôpital dans l'enclos de Québec, un fief de soixante arpents dans la banlieue, elle envoya des ouvriers pour commencer les défrichements et préparer un logement, afin que ses hospitalières eussent un pied-à-terre en arrivant au Canada:

"Dieu m'ayant donné, écrivait-elle au P. Le Jeune, le désir d'aider au salut des pauvres sauvages, après avoir lu la relation que vous en avez faite, il m'a semblé que ce que vous croyez qui puisse le plus servir à leur conversion, c'est l'établissement des religieuses hospitalières en la Nouvelle-France: de sorte que j'ai résolu d'y envoyer cette année six ouvriers pour défricher les terres et faire quelque logement pour ces bonnes filles. . . ."

Pour l'exécution de son pieux dessein, elle jeta les yeux sur les religieuses Augustines de l'Hôtel-Dieu de Dieppe; et ces religieuses, avec un courage vraiment héroïque, et l'agrément de leur évêque, Mgr de Rouen, se décidèrent à entreprendre cette tâche: ce qu'elles firent au printemps de 1639.

Bien héroïque, en effet, cette résolution; plus héroïque encore, peut-être, la persévérance incomparable avec laquelle elle fut menée à bonne fin, malgré des obstacles en apparence insurmontables. Si l'on admire la vaillance et l'intrépidité de nos anciens missionnaires, qui vinrent ici, au prix de tant de sacrifices, de misères et de dangers de toutes sortes, établir le règne de Dieu, quelle idée extraordinaire ne doit-on pas avoir de ces femmes au cœur noble et généreux, qui ne reculèrent pas devant un voyage, devant une entreprise, devant des travaux qui, dans les conditions où tout cela devait se faire à cette époque, nous semblent vraiment au-dessus des forces humaines?

Et ce qu'il y a de plus étonnant, c'est qu'il y eut parmi ces religieuses de Dieppe une sainte émulation à qui irait se dévouer pour la mission du Canada. Il fallait pourtant se borner; et le choix des

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[1] *Edits et Ordonnances*, t. I, p. 5.

[2] "Hélas! écrivait le P. Le Jeune en 1635, est-ce qu'on ne trouvera point quelque brave dame qui donne un passeport à ces amazones du grand Dieu, leur dotant une maison, pour louer et servir sa divine Majesté en ce nouveau monde?" (*Relations des Jésuites*, 1635, p. 2).

directrices tomba sur trois d'entre elles[1], dont la plus âgée, Marie Guenet, n'avait pas trente ans. C'était la fille d'un riche banquier de Rouen, membre de la compagnie des Cent-Associés. Elle fut la première supérieure de la petite communauté augustine de Québec.

On ne peut lire sans émotion la lettre que lui écrivait la duchesse d'Aiguillon quelques jours avant son départ pour le Canada, et tout particulièrement les lignes suivantes, ajoutées en marge de cette lettre:

"Ma bonne Mère, obligez-moi de prendre soin de demander aux sauvages que vous assisterez à la mort, le salut de monseigneur le cardinal, celui de quelques personnes à qui j'ai de particulières obligations, et le mien, et que toutes vos religieuses me fassent la même charité."[2]

Le voyage de ces saintes religieuses, qui dura trois mois,[3] en comptant les quinze jours qu'il fallut passer au large dans la rade de Dieppe, à cause des tempêtes, les incidents et les péripéties de ce voyage, l'arrivée à Québec, les commencements si pénibles de l'Hôtel-Dieu, puis son établissement solide et durable, ses épreuves, ses travaux et ses œuvres: tout cela a été raconté admirablement par la première annaliste de cette institution, la Sœur Juchereau;[4] tout cela fut repris ensuite et continué jusqu'à nos jours par notre éminent confrère de la Société Royale, l'abbé Casgrain. Son *Histoire de l'Hôtel-Dieu de Québec* est certainement l'un des meilleurs, et peut-être le meilleur de ses nombreux ouvrages.

Les seize premières religieuses de l'Hôtel-Dieu de Québec venaient de France, la plupart de Dieppe, quelques-unes cependant de la Bretagne (Vannes, Quimper, Tréguier).

La première religieuse canadienne de l'institution, Françoise Giffard, fit profession en 1650; et à partir de cette date la France n'eut plus à envoyer de sujets à l'Hôtel-Dieu de Québec.

Françoise Giffard, fille de Robert Giffard, le premier seigneur de Beauport, prit en religion le nom de Saint-Ignace, qu'avait si noblement porté la première supérieure, Marie Guenet, qu'on peut bien appeler la véritable fondatrice de l'Hôtel-Dieu de Québec, au point de vue spirituel, et qui fit tant de bien au Canada pendant les quelques années qu'elle y vécut: elle mourut, hélas! moins de sept ans après son arrivée à Québec: elle n'était âgée que de trente-six ans!

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[1] Marie Guenet, dite Saint-Ignace; Anne Lecointre, dite Saint-Bernard; Marie Forestier, dite Saint-Bonaventure de Jésus.

[2] *Relations des Jésuites*, 1639, p. 10.

[3] Le départ de Dieppe eut lieu le 4 mai, et elles n'arrivèrent à Québec que le premier août.

[4] *Histoire de l'Hôtel-Dieu de Québec.* A Montauban, chez Jérosme Legier . . . 1751.

Le Père Le Jeune, toujours très sobre de compliments, écrivait cependant à son sujet à la supérieure de Dieppe: "Cette bonne Mère est docile, franche et candide. Tant que vos Sœurs garderont cet esprit, elles ne manqueront point de secours."

Puis il ajoutait: "Les Français et les Sauvages aiment vos Sœurs. Les Sauvages les appellent les bonnes, les charitables, les libérales. Je prie Dieu qu'il continue sa bénédiction sur cette maison."

Il ajoutait encore: "Tout est si changeant en cette vie, qu'on se doit défier de tout, et plus de nous-mêmes que de toute autre chose."[1]

Quelle sublime parole! Quel admirable parfum de vertu! Faut-il s'étonner que sous la conduite de prêtres aussi foncièrement religieux que nos anciens missionnaires jésuites, les communautés naissantes de Québec aient produit tant de fruits merveilleux de charité, de bienfaisance, d'édification de toutes sortes?

Ce que dit le Père Le Jeune de l'affection des Français et des Sauvages pour les religieuses de l'Hôtel-Dieu de Québec nous rappelle un petit passage de Mgr Dupauloup:

"La religion, dit-il, entre autres choses admirables qu'elle a créées sur la terre, a créé la Sœur. Quelque habit, quelque nom qu'elle porte, qu'elle fasse l'école du village ou qu'elle visite l'indigent des villes, ou qu'elle soigne le malade dans les hôpitaux, ou s'immole, hostie vivante, victime d'expiation dans l'holocauste de la prière et de la pénitence, c'est la *Sœur*, c'est toujours la Sœur; et ce nom si doux, symbole de pureté et d'innocence, de sacrifice et de vertu, d'amour et de désintéressement, sera toujours, quoi qu'on fasse, cher et sacré au cœur des peuples."[2]

La première supérieure de l'Hôtel-Dieu de Québec n'était pas un écrivain, comme celle qui prit après elle le nom de Saint-Ignace, ou comme plus tard la Sœur Juchereau et la Sœur Duplessis. Elle avait trop à faire pour tenir journal ou entretenir une correspondance suivie. Nous ne connaissons d'elle qu'une lettre; et cette lettre est restée complètement inédite jusqu'à ces derniers temps, qu'elle a été publiée par un érudit de Rouen, M. Cahingt. Elle nous donne une haute idée de la vertu de cette religieuse, que cet érudit ne craint pas d'appeler "une admirable femme," et qui, comme Marie de l'Incarnation, s'attacha à notre pays, pourtant si pauvre à cette époque, au point de l'appeler, dans cette lettre, "le vrai paradis des religieuses."

Outre cette lettre, nous savons par son propre témoignage que la Mère Saint-Ignace écrivit sur son hôpital une Relation, qu'elle

[1] Cité par M. H. Cahingt dans son intéressante brochure *Documents sur le Canada* (*1639-1660*), p. 20.

[2] Cité par Emile Faguet dans son beau livre sur Mgr Dupanloup.

adressa à l'archevêque de Rouen. Qu'est devenue cette Relation? Existe-t-elle encore? Nous n'en savons rien. Ce qui est certain, c'est que l'archevêque, mécontent de ce que les Jésuites n'avaient pas encore reconnu sa juridiction au Canada[1], et ne faisaient aucune mention de lui dans leurs *Relations*, en exprima quelque part son mécontentement. La supérieure de l'Hôtel-Dieu de Dieppe en écrivit à celle de Québec; et celle-ci de répondre:

"Je n'avais garde d'écrire une relation à Mgr l'archevêque. Vous savez que je n'ai point d'habitude pour cela; et de plus les occupations que nous avons pour la quantité de malades qu'il nous faut assister, l'infirmité assez grande où nous succombâmes toutes l'une après l'autre, à force de travail, les provisions qu'il fallait recevoir et visiter, la maison que nous faisions accommoder à notre usage,[2] tout cela ne nous donnait pas seulement le temps de penser si nous étions en Canada, et ce que nous y faisions. Cette année (1640), j'ai envoyé à Sa Grandeur un recueil de choses les plus particulières qui se soient passées en notre hôpital. Je ne pense pas néanmoins que cela le contente; car, à ce que je puis entendre, il désirerait la *Relation* de ce pays; mais elle n'est pas en ma disposition."

Voilà qui peint bien le caractère de cette femme: sa sagesse et son bon sens étaient à la hauteur de sa vertu. Elle entendait bien ne s'occuper que des affaires de son couvent et de son hôpital, et ne se croyait nullement chargée de conduire le pays, ou de raconter ce qui se passait en dehors du monastère.

Nous avons dit qu'à partir de 1650 il ne vint plus à l'Hôtel-Dieu de Québec aucune religieuse de France. Mais cette belle institution reste toujours en relation assidue de correspondance, de prières et d'amitié avec celle de Dieppe. La mère ne perd jamais de vue sa fille bien-aimée, elle s'intéresse à son sort, à ses œuvres, à ses progrès; la fille, également, demeure très attachée à sa mère, et ne perd pas de vue son berceau. Chaque année, il y a une circulaire qui part de la maison-mère, et va rendre compte à toutes les maisons de l'ordre des principaux événements, heureux ou malheureux, qui se sont passés dans la grande famille augustine. S'ils sont heureux, chacun s'en réjouit et en rend grâces au Seigneur: s'ils sont malheureux, on sympathise avec les affligés, on prie pour eux, on se montre même disposé à leur venir en aide dans la mesure du possible.

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[1] Sur la juridiction de l'archevêque de Rouen au Canada, voir notre volume *La Mission du Canada avant Mgr. de Laval*, p. 101, 102, 144, ainsi que nos articles publiés en 1895 dans la *Revue Catholique de Normandie*.

[2] La maison des Cent-Associés, qui fut mise tout d'abord à la disposition des Hospitalières, grâce, sans doute, à l'influence de M. Guenet, père de la Mère Saint-Ignace.

II

Hélas! qui ne connaît la situation triste et lamentable faite aux communautés religieuses de France, en ces derniers temps, par le gouvernement de notre ancienne mère patrie? Les Hospitalières de Dieppe ont été frappées comme partout ailleurs, avec certains ménagements, cependant. L'administration de leur hôpital leur a été enlevée, l'hôpital est laïcisé, et administré par des directeurs laïques, dont le maire de la ville est le président. Les religieuses Hospitalières, toutefois, sont encore là, mais à titre d'employées, de salariées. Elles occupent leur monastère et conservent leur noviciat, mais se recrutent bien difficilement: tant les circonstances sont misérables, et l'avenir incertain! Leur hôpital, autrefois si prospère, périclite. La supérieure, écrivant à celle de Québec le 20 décembre 1910:

"Hélas! disait-elle, nos œuvres françaises sont bien loin du développement des vôtres! La guerre religieuse les entrave, et s'oppose de toutes manières, surtout par l'éducation, au recrutement de sujets qui nous est nécessaire pour continuer nos saintes fonctions. C'est à ce sujet que je viens solliciter votre charité.

"Actuellement, ajoutait-elle, nous ne sommes pas assez nombreuses pour tenir tous les services de la maison. Plusieurs, déjà, sont laïcisés, d'autres le seront, si nous n'y pouvons pourvoir. Cependant telle n'est pas l'intention de la commission administrative, qui me supplie de leur procurer des religieuses, afin de ne pas continuer la laïcisation.

"J'ai frappé en vain à bien des portes. Nos chères maisons-sœurs, de Bretagne ou de Normandie, ne peuvent nous aider, subissant la même crise que nous. Depuis un mois environ j'ai commencé ces démarches: c'est à vous, aujourd'hui, malgré l'éloignement et la différence respective de nos maisons, que je viens m'adresser. Parmi vos nombreuses postulantes et novices, peut-être s'en trouverait-il qui, sur votre demande, consentiraient à s'expatrier pour sauver l'honneur et l'existence du cher Berceau de l'Ordre; ou, parmi vos religieuses, quelques unes accepteraient-elles d'échanger leur vie, plus heureuse par les conditions libres dont vous jouissez, contre notre vie, certainement pénible, où l'abnégation et le sacrifice sont de chaque instant pour la Sœur hospitalière?

"J'espère que, si vous le pouvez, vous réaliserez ma demande, que je vous fais avec d'humbles et pressantes instances, confiant son succès à notre bon Sauveur, afin que sa charité vous inspire, que la générosité de son sublime sacrifice anime quelques âmes vaillantes

à lui rendre amour pour amour par le don total d'elles-mêmes et l'abandon de tout ce qu'elles ont de plus cher ici-bas."[1]

Les Hospitalières de Québec étaient bien dignes de la confiance avec laquelle on recourait à leur bonne volonté, en leur présentant les choses avec tant de franchise, sans aucun fard, sans aucun allèchement trompeur; et nous ne pouvons douter que leur premier mouvement fut d'acquiescer sans délai à la demande de leurs Sœurs d'outre-mer et de s'offrir pour aller "sauver l'honneur et l'existence du Berceau de leur Ordre."

Mais il fallait, dans une affaire d'une telle importance, consulter leur évêque; et le prélat, dans sa grande sagesse, avait besoin d'examiner si la communauté pouvait raisonnablement faire le sacrifice qu'on lui demandait. Elle venait précisément d'envoyer quelques-unes de ses religieuses au secours d'un autre hôpital, tenu, lui aussi, par des Sœurs Augustines, à Waterloo, près de Liverpool, en Angleterre. N'allait-on pas, par l'envoi d'un autre renfort à l'Hôtel-Dieu de Dieppe, affaiblir d'une manière excessive celui de Québec? Ne nous étonnons donc pas de la réponse que la supérieure de Québec se vit obligée de faire, quelques semaines plus tard, à sa vénérée Sœur de Dieppe:

"Au lieu de vous annoncer aujourd'hui, écrit-elle, la joyeuse nouvelle d'un renfort pour le soutien de vos œuvres, j'ai la douleur de vous déclarer que Sa Grandeur Mgr notre archevêque, consulté dans une affaire de si grande importance, s'oppose absolument à ce que nous détachions de nouveaux sujets de notre maison, après avoir prêté les trois qui sont actuellement à Waterloo.

"Monseigneur suit de près notre hôpital. Il voit le travail épuisant que nous imposent les exigences actuelles de la chirurgie, de la médecine même, dans les cas de fièvres, si nombreux cette année. Il sait que souvent huit religieuses, la nuit, veillent à la fois,—et quelles veilles!—un vrai surménage! Il sait que chez plusieurs la santé décline sensiblement, et que, sans être précisément hors de combat, bien des jeunes sont obligées à des ménagements qui nécessitent un plus grand nombre de religieuses dans leurs offices, à ce point que des préparantes au brevet doivent actuellement interrompre leurs études pour aller secourir leurs Sœurs surchargées de travail. Sans cesse obligée de fortifier les anciens offices et d'en créer de nouveaux, la supérieure, malgré le grand nombre de ses religieuses, est littéralement pauvre de sujets pour suffire à la tâche quotidienne.

"Il a fallu, veuillez le croire, toutes ces raisons très graves pour empêcher Mgr Bégin de nous laisser voler au secours de notre cher

[1] Cette pièce et toutes celles qui suivent nous ont été obligeamment communiquées par l'archiviste de l'Hôtel-Dieu de Québec.

berceau religieux d'une communauté à qui nous devons tout ce qu'est la nôtre, et dont la nâvrante situation nous a brisé le cœur. Sa Grandeur qui, l'été dernier, nous avait permis d'aller secourir nos Sœurs de Waterloo, nous a retiré plus tard cette autorisation, la prudence faisant taire en cela sa bonté naturelle...."

Et la bonne supérieure signait sa lettre: "Votre Sœur affligée *mais pleine de confiance.*"

Ces derniers mots en disaient plus que des volumes pour rassurer les Hospitalières de Dieppe, et leur donner l'espoir que rien n'était désespéré.

On avait allégué, pour donner à Dieppe une réponse dilatoire, la crainte de trop affaiblir l'Hôtel-Dieu de Québec en faisant partir quelques religieuses pour la France. Cette crainte était certainement réelle et bien fondée. Mais sait-on quelle était aussi la grande préoccupation de Mgr l'archevêque et des Hospitalières de Québec dans toute cette affaire? On voulait s'assurer, avant d'envoyer en France des religieuses, si la chose ne se ferait pas un peu au détriment de l'esprit religieux et traditionnel qui règne à Québec d'une manière si admirable. Non pas que l'on eût le moindre doute sur l'esprit religieux de la communauté elle-même de Dieppe: mais le fait de la laïcisation de l'hôpital et des rapports quotidiens des Hospitalières avec une administration laïque ne pouvait-il pas inspirer quelque crainte au sujet de nos religieuses, qui se verraient tout à coup dans une situation à laquelle elles étaient peu préparées? C'était là, surtout, l'objet de la préoccupation des Hospitalières de Québec: on le voit bien par les paroles que leur adressait la supérieure dans une assemblée du Chapitre de la maison:

"Sachant, dit-elle, le désir manifesté par plusieurs d'entre nous d'aller payer au berceau de notre Institut une faible partie de la dette de reconnaissance contractée ici par le dévouement de nos saintes fondatrices, j'ai prié Sa Grandeur Mgr l'archevêque de vouloir bien s'informer auprès du supérieur ecclésiastique de nos Mères de Dieppe, pour savoir, 1o. si les règlements de leurs administrateurs leur permettent d'observer fidèlement notre règle et nos constitutions; 2o. si nos Sœurs employées à l'hôpital y pourront accomplir journellement tous leurs exercices spirituels; 3o. si dans le milieu où elles doivent exercer les fonctions d'hospitalité elles ne seront pas exposées à perdre leur esprit religieux."

Mgr l'archevêque de Québec ayant écrit à ce sujet à M. Véniard, le digne supérieur des Hospitalières de Dieppe, en reçut la réponse suivante:

"En réponse à la lettre de Votre Grandeur en date du 28 février dernier, j'ai l'honneur de communiquer ci-inclus le règlement des

Religieuses de l'Hôtel-Dieu de Dieppe, avec les observations de la révérende Mère supérieure.

"Je crois que ce règlement est capable de lever les dernières hésitations des Sœurs de Québec, d'autant mieux que l'administration civile apporte en général dans ses rapports avec les Sœurs une grande bienveillance, et même une certaine déférence envers la supérieure . . . .

"Veuillez donc, monseigneur, examiner la possibilité de nous envoyer trois ou quatre religieuses, ou à leur défaut trois ou quatre postulantes, qui consentiraient à passer leur vie religieuse aux Hospices de Dieppe.

"Nous vous serions reconnaissants de nous faire connaître quelle serait, dans vos intentions, la durée de leur séjour en France, car je n'ose vous demander un exode à perpétuité.

"Permettez-moi, en terminant, de faire appel à votre haute sagesse pour le choix des sujets, car elles auraient, ces chères filles, à consentir des sacrifices pour s'accommoder à une vie moins facile que chez vous!"

Qui n'admirerait, dans ces négociations, la sagesse, la franchise et la sincérité qui président à tout ?

Une fois la réponse de M. Véniard arrivée à Québec, la décision de l'archevêque et celle des Hospitalières ne se firent guère attendre. L'assemblée capitulaire dont nous avons parlé eut lieu le 14 mars: il y fut résolu qu'on enverrait quatre sujets à Dieppe. La supérieure fit alors venir toutes les professes de chœur et leur dit: "Que toutes celles qui, spontanément, voudraient aller porter secours à nos Mères de Dieppe, me donnent leur nom par écrit, afin que le Chapitre puisse choisir quatre d'entre elles pour cette bonne œuvre de sacrifice et d'abnégation."

Vingt religieuses sur cent-dix se déclarèrent disposées à passer en France. Voici les noms des quatre privilégiées qui furent choisies par le Chapitre: Claudia Mayrand, en religion Saint-Jean de Dieu; Joséphine Turgeon, dite Sainte-Gertrude; Augustine Jobidon, dite Saint-Marc; Alice Doyle, en religion Saint-Henri.[1]

Le 30 avril 1912, jour anniversaire de la naissance de Mgr de Laval, son seizième successeur sur le siège épiscopal de Québec, Mgr Bégin, donna à ces quatre religieuses la belle lettre d'obédience que nous allons citer, et qui nous semble comme un écho de celle que l'archevêque de Rouen, Mgr de Harlay, adressait autrefois, de son château de Gaillon,[2] aux trois fondatrices de l'Hôtel-Dieu de Québec:

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[1] Voici, dans le même ordre, leur lieu respectif de naissance: Deschambault, Saint-Isidore, Château-Richer, Saint-Jacques de Leeds.

[2] *La Mission du Canada avant Mgr. de Laval*, p. 74.

"J'ai pris connaissance, écrit-il à la supérieure Saint-Dominique,[1] de la demande que vous ont faite nos bonnes Mères Augustines de l'Hôtel-Dieu de Dieppe. Les circonstances pénibles dans lesquelles elles se trouvent à cause du manque de sujets pour soutenir leur œuvre séculaire, les font recourir à leurs chères Sœurs de Québec pour en obtenir, au moins temporairement, quelques religieuses. Vous n'avez pas oublié ce que votre maison-mère de Dieppe a fait pour votre Hôtel-Dieu, qu'elle fondait à Québec en 1639, et vous voulez lui donner un témoignage de votre affection et de votre reconnaissance.

"Parmi les nombreuses religieuses qui aspirent à l'honneur de voler au secours de Dieppe, votre Chapitre en a choisi quatre qui, je n'en doute aucunement, s'acquitteront consciencieusement et avec succès de la tâche qui leur sera assignée.... Elles ont déjà donné des preuves de leur dévouement et de leur savoir-faire. Je leur donne volontiers l'obédience requise, pour deux ans, avec liberté à elles de revenir plus tôt, soit de leur volonté, soit par une décision de la communauté de Dieppe en cas de maladie ou pour autre cause.

"Il m'est agréable de voir la Nouvelle-France aller au secours de l'ancienne, que nous aimons toujours, malgré les misères et les rudes épreuves de l'heure présente.

"De tout cœur je bénis les chères missionnaires. Je leur souhaite du bonheur et du succès dans leurs labeurs. Je désire qu'elle soient un sujet de grande édification dans la famille religieuse de Dieppe."

A son tour, la supérieure de l'Hôtel-Dieu donna à ses quatre religieuses une lettre d'obédience le 25 mai, jour même de leur embarquement:

"Nous faisons savoir à qui il appartiendra, dit-elle, que les susdites Sœurs sont envoyées par nous en France pour aider dans leurs œuvres d'hospitalité nos révérendes Mères de l'Hôtel-Dieu de Notre-Dame-Auxiliatrice, à Dieppe, et conséquemment nous leur donnons la présente lettre d'obédience."

Le voyage de Québec à Liverpool se fit fort heureusement. Nous le savons par un journal très intéressant tenu à bord du vaisseau le *Laurentic* par la bonne Sœur Saint-Jean de Dieu. Nos voyageuses arrivèrent le 2 juin à Liverpool, d'où elles allèrent rendre une courte visite à leurs Sœurs de Waterloo. Puis elles se hâtèrent de se mettre en route pour Dieppe, où elles arrivèrent le 8 juin et reçurent à l'Hôtel-Dieu un accueil d'une indescriptible joie.

Un journal de l'endroit rendait compte de leur arrivée en termes très élogieux et sympathiques:

[1] Née Beaudry, de la Pointe-aux-Trembles de Québec.

"D'accord avec son évêque, écrivait-il, la Communauté des Sœurs de Saint-Augustin de Québec ayant reçu l'appel des Sœurs de Dieppe a voulu y répondre. Le Canada, lui sembla-t-il, ne pouvait faire autrement que de rendre à notre ville ce qu'elle lui avait prêté quand il naissait à peine à la civilisation, voilà près de trois siècles.

"Elle détacha de ses services médicaux, à notre profit, quatre Sœurs canadiennes de l'Hôpital de Québec, instruites, pourvues de leurs brevets et diplômes. Celles-ci viennent d'arriver au cloître de l'Hôpital de Dieppe en parfaite santé, après une heureuse traversée. Aujourd'hui elles sont prêtes à prendre avec dévouement leur pénible service."

Les Sœurs de Dieppe ne tardèrent pas à apprécier le trésor qu'elles avaient reçu dans la personne de nos religieuses canadiennes, qui par leur savoir, leur habileté et leur expérience font l'admiration de tous ceux qui les voient à l'œuvre. Les administrateurs laïques de l'Hôpital en étaient ravis. Le maire de Dieppe, leur président, écrivant un jour à la supérieure de Québec:

"Au nom de la commission administrative, disait-il, permettez-moi de vous transmettre l'expression de sa reconnaissance et de ses remerciements les plus sincères pour l'obligeance que vous avez eue de répondre favorablement à l'appel qui vous a été adressé par Madame la supérieure des religieuses Hospitalières de l'Hôpital de Dieppe, en lui envoyant des religieuses de votre communauté, qui rendent, et continueront de rendre longtemps encore, nous l'espérons, les plus signalés services à notre établissement hospitalier."

Quant à nos religieuses canadiennes elles-mêmes, elles étaient contentes de leur sort et se montraient heureuses de pouvoir faire quelque chose pour leurs compagnes de France:

"J'ai reçu une charmante lettre de vos Sœurs québécoises de Dieppe, écrivait Mgr Bégin le 8 septembre 1912 à la supérieure de l'Hôtel-Dieu. Elles jouissent d'une bonne santé, sont traitées avec beaucoup de bienveillance et d'égards, se dévouent gaiement au soin des malades et sont heureuses."

Une d'elles, Saint-Marc, cependant, tomba malade, et fut obligée de revenir avant le temps au Canada.

Dans le voyage qu'il fit en Europe quelques mois plus tard, le digne archevêque de Québec ne manqua pas de rendre visite à ses diocésaines à Dieppe, et put constater par lui-même les grands services qu'elles rendaient, et l'estime qu'on leur portait. La supérieure de Dieppe écrivait à l'occasion de cette visite:

"Le 18 mars (1913), nous avions le privilège d'assister à la sainte messe célébrée par Sa Grandeur Mgr Bégin, et d'y communier de sa main. Sa Grandeur, arrivée de Paris la veille, venait; avant de re-

tourner à Québec, donner à ses chères filles exilées un nouveau témoignage de son affection paternelle, en leur consacrant quelques heures. Il voulut bien accepter notre modeste hospitalité, et s'en trouver satisfait. Nous avons pu, dans son entretien familier, juger de sa bonté condescendante, non moins que de sa sympathie pour Dieppe."

De son côté, M. Véniard écrivant quelques mois plus tard à Mgr Bégin lui-même:

"Nous avons conservé, disait-il, un souvenir particulièrement reconnaissant de votre si paternelle visite à Dieppe...." Puis il ajoutait: "Notre situation est toujours la même en notre maison Hospitalière. Le recrutement est toujours très difficile, et nous serions heureux que vous nous laissiez encore nos trois Religieuses Canadiennes pour tel délai qu'il vous plairait de fixer. Elles ont été jusqu'ici de précieuses et dévouées auxiliaires, et elles nous rendraient encore bien service.... Nous confions à votre bienveillance notre situation précaire, et je vous prie, monseigneur, d'agréer l'assurance de notre gratitude.."

Mgr Bégin ne put refuser d'accéder à un appel à la fois si touchant et si honorable pour le Canada:

"Faites votre possible, écrivit-il à la supérieure de notre Hôtel-Dieu, pour laisser vos trois Sœurs à Dieppe, et vous ferez un acte de charité très méritoire et presque nécessaire dans les circonstances pénibles où se trouvent les Hospitalières de Dieppe."

L'obédience de nos religieuses fut donc renouvelée pour deux ans, leur permettant, par conséquent, de prolonger leur séjour en France jusqu'au printemps de 1916. La Sœur Saint-Jean de Dieu écrivant le 29 janvier dernier à sa supérieure à Québec:

"La bonne nouvelle, disait-elle, nous est arrivée le 24 janvier. La joie de la communauté était grande, en apprenant que notre obédience était renouvelée pour deux ans. Les angoisses de notre Mère avaient été extrêmes, en songeant à la pénible situation où elle se serait trouvée par notre départ: trois emplois, et pas des moins importants, à pourvoir de religieuses, et personne pour les remplir.

"Aussi, malgré l'immense bonheur que nous aurions goûté en vous revoyant, nous faisons généreusement le sacrifice de prolonger notre exil, espérant que Dieu se laissera toucher et nous accordera quelques bons sujets. Nos Mères en auraient tant besoin pour pouvoir continuer leur œuvre séculaire de charité."

Puis elle ajoutait:

"L'administration est de plus en plus bienveillante; et hier, à une séance de la commission administrative, il a été résolu que Madame la supérieure serait investie du titre de surveillante générale

des services hospitaliers et annexes, avec droit de contrôle sur le personnel quel qu'il soit. Il en était ainsi autrefois, mais depuis la persécution contre les communautés religieuses, tout pouvoir lui était retiré. Maintenant que ces messieurs ont vu par eux-mêmes les inconvénients de leur nouveau mode d'administration, ils reviennent d'eux-mêmes prier notre révérende Mère de vouloir bien leur aider à porter la responsabilité et faire régner l'ordre partout. C'est un grand point de gagné.

"Espérons qu'un jour il nous sera aussi donné de pouvoir rendre au crucifix la place d'honneur dans les salles de nos pauvres malades, et plus entière liberté pour leur parler du Bon Dieu. Espoir et confiance! Il luira, il faut l'espérer, de meilleurs jours sur cette pauvre France, qui n'est si malheureuse que parce qu'elle a abandonné son Dieu. . . ."

Une nouvelle lettre du maire de Dieppe à la supérieure de l'Hôtel-Dieu de Québec, reçue quelques jours plus tard, témoignait également des bons sentiments des administrateurs laïques à l'égard des religieuses:

"Madame la supérieure des religieuses Hospitalières de l'Hôpital de Dieppe, écrivait le maire, a bien voulu faire connaître à la commission administrative la bienveillante décision que vous avez prise à son égard en maintenant ici pour deux nouvelles années les religieuses de votre communauté qui depuis 1912 rendent de précieux services à l'Hôpital de Dieppe, où elles ont acquis par leur bienveillance et leur savoir-faire l'estime, la sympathie et la considération de tous.

"En vous priant, madame la supérieure, de vouloir bien agréer mes remerciements personnels, je suis heureux de vous transmettre également ceux de la commission administrative, qui a été vivement touchée de l'heureuse décision que vous avez prise à l'égard des Sœurs Saint-Jean de Dieu, Sainte-Gertrude et Saint-Henri. . . ."

Quel est le Canadien qui ne se sentirait fier, en voyant nos religieuses si bien appréciées à l'étranger,—je me trompe, on ne peut pas dire que la France est un pays étranger pour nous,—si aimées, si respectées dans notre ancienne mère patrie, faire tant d'honneur à leur pays, non seulement par leurs vertus, mais aussi par leur habileté et leur savoir-faire, par leur esprit de progrès dans l'exercice de leurs fonctions comme hospitalières?

On a pu remarquer dans toutes les pièces que nous avons citées, au cours de ce mémoire, que l'idée qui domine partout, c'est que nos religieuses du Canada s'en vont à Dieppe payer une dette de reconnaissance au Berceau de leur Institut, et rendre à la France quelque chose, au moins, de ce qu'elle fit autrefois pour nous avec tant de géné-

rosité et de bonne volonté. N'y a-t-il pas dans cette touchante réciprocité de services entre la nouvelle et l'ancienne France, entre Québec et Dieppe, une des plus belles pages de l'histoire religieuse de notre pays ?

Le Rituel de Mgr de Saint Vallier.

Par MGR AMÉDÉE GOSSELIN

(Lu le 27 mai, 1914)

Le *Rituel de Québec*, connu plus généralement sous le titre de *Rituel de Mgr de Saint-Vallier*, a été en usage, dans le diocèse, officiellement du moins, de 1703 à 1836. Il a donc de bons états de services.[1] C'est pourquoi, avant que le souvenir ne s'en efface chez notre clergé et que les rares exemplaires qui restent de ce précieux ouvrage ne se perdent, pour ainsi dire, dans la poussière des bibliothèques, nous avons voulu essayer d'en raconter la genèse et de faire connaître les incidents qui ont suivi sa publication. Ce sera le sujet de ce travail historico-bibliographique.

Lorsque, succédant à Mgr de Laval, en 1688, Mgr de Saint-Vallier prit l'administration de l'Eglise de Québec, il trouva celle-ci sans rituel particulier. Plusieurs églises de France comme celles de Paris, de Rheims, de Soissons, d'Amiens &c., avaient pourtant leur rituel propre. Pourquoi Mgr de Laval n'avait-il pas adopté l'un ou l'autre de ces rituels, celui de son diocèse d'origine, par exemple ?

Le premier évêque de Québec était *romain* jusque dans la moëlle des os. Il écrivait au Saint-Siège dans son rapport de 1660:[2] "Romanum ritum hic omnes sequimur." Nous suivons tous ici le rit romain. Mgr de Laval ne dévia point de cette ligne de conduite durant tout son épiscopat. Avant la publication du rituel de Mgr de Saint-Vallier, on se servait certainement du rituel romain dans plusieurs églises du diocèse, sinon dans toutes.

L'Université Laval conserve dans sa bibliothèque quelques exemplaires anciens du rituel romain dont l'un a servi aux deux premiers curés de Québec, MM. de Bernières et Dupré. Des notes inscrites sur l'une des pages du volume en font foi. Au reste, le dit volume, imprimé en 1658, est très fatigué; les pages, en plusieurs endroits, sont usées, déchirées, salies ou maculées de cire jaune. Un autre exemplaire que nous avons sous les yeux, porte, lui aussi, les marques d'un usage prolongé.

Des *Extraits du Rituel Romain*, plus portatifs et, par suite, plus commodes pour l'administration des sacrements, furent toujours

[1]Voir une ordonnance de Mgr. Signaÿ au sujet d'un extrait du Rituel. Mandements des Evêques, Vol. III., p. 343.

[2] Mandements des Evêques, Vol., I., p. 21.

permis dans le diocèse, même après l'apparition du volume de Mgr de Saint-Vallier. On peut voir dans la bibliothèque de l'Université Laval des exemplaires de ces *Extraits* ayant appartenu à MM. Récher curé de Québec de 1749 à 1768, Briand, chanoine et futur évêque de Québec, Le Guerne, ancien missionnaire de l'Acadie.

A l'exemple de plusieurs évêques de France, Mgr de Saint-Vallier crut devoir, pour l'utilité de son clergé, ajouter au rituel romain, mais en langue française, des instructions ou explications plus détaillées concernant des points de dogme, de morale ou de liturgie et l'administration des sacrements. On y trouve aussi des prônes pour les dimanches et les principales fêtes de l'année, des formules pour l'enregistrement des actes de baptême, de mariage et de sépulture, pour les testaments &.

Dès les premières années de son épiscopat, croyons-nous, le second évêque de Québec travailla à mettre son projet à exécution. Nous n'en trouvons cependant aucune mention avant 1696. Mgr de Saint-Vallier était alors en France depuis décembre 1694. Peu de temps après son arrivée à Paris, c'est-à-dire dans les premiers mois de 1695, il s'était occupé, paraît-il, de compléter la composition de son rituel, de son catéchisme et du recueil de ses ordonnances. L'abbé Tremblay[1] à qui nous empruntons ce détail, croyait même que le prélat avait fait imprimer ces ouvrages durant l'hiver.[2]

Quelques mois plus tard, le 3 Juin 1696, l'abbé Tremblay, écrivant de nouveau aux Messieurs du Séminaire de Québec, affirme la même chose, en substance, tout en se contredisant pour les détails: "Monseigneur, dit-il, a trouvé moyen de s'occuper quatre mois entiers de cet été[3], c'est-à-dire depuis le départ de nos vaisseaux jusqu'à la fin d'août, à dresser un rituel, un catéchisme et un recueil de ses ordonnances. Il fait actuellement imprimer toutes ces choses et les doit emporter avec lui en Canada.[4]"

Qu'y avait-il de vrai dans cette nouvelle que M. Tremblay réédite à deux mois d'intervalle? Tout simplement que l'évêque travaillait à compléter ces divers ouvrages. Car, pour ce qui est de l'impression des volumes, nous ne croyons pas qu'elle ait été commencée à cette date. Que Mgr de Saint-Vallier ait pensé à l'entreprendre; qu'il ait même cherché un libraire qui consentît à s'en charger, c'est possible et nous sommes bien porté à croire, en effet, que l'auteur du Rituel a fait alors des démarches en ce sens, mais pas davantage.

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[1] L'abbé Henri Tremblay, des Missions Etrangères de Paris, était procureur du Séminaire de Québec en France. Il avait passé quelques années au Canada.

[2] Lettre du 29 mars 1696. (Archives du Séminaire de Québec).

[3] Il s'agit de l'été de 1695 comme on peut le constater par le contexte.

[4] Archives du Séminaire de Québec.

Quoi qu'il en soit, Mgr de Saint-Vallier revint à Québec au mois de septembre 1697, et, contrairement à ce qu'avait laissé entendre l'abbé Tremblay, il n'apportait pas avec lui les ouvrages en question.

Au mois de février suivant (1698), l'évêque présidait, à Québec, le troisième synode diocésain qu'il fit suivre d'un quatrième le 8 octobre 1700. Lors de cette dernière réunion, Mgr de Saint-Vallier s'adressant à son clergé lui aurait dit ce qui suit: "Nous vous présentons, Nos Très Chers Frères, le Rituel que vous avez désiré depuis si longtemps, et que Nous avons fait pour le bon ordre de ce diocèse et pour l'uniformité de la discipline ecclésiastique. Nous vous assurons que dans le voyage que Nous allons faire en France pour les besoins de cette église (que vous devez recommander à N.S.), Nous le ferons imprimer pour vous l'envoyer ou l'apporter Nous-même le plus tôt qu'il Nous sera possible."[1]

Voilà qui paraît bien catégorique: vous attendez un rituel depuis longtemps, il est prêt, le voici. Seulement, il est encore manuscrit.

Quelques jours plus tard, le 13 octobre, le prélat s'embarquait sur le vaisseau *La Seine* pour la France et, le 24 décembre, il était rendu à Paris.

Après avoir expédié les affaires les plus pressantes, l'évêque s'occupa de la publication de ses ouvrages. Le *Privilège du Roi* ou Permis d'imprimer requis en pareil cas, est daté de Versailles, le 13 avril 1702.

L'impression du Catéchisme, faite à "Paris, chez Urbain Coustelier," fut terminée cette année-là même. Le libraire Simon Langlois se chargea de faire imprimer le Rituel et les Ordonnances. L'ouvrage ainsi partagé entre deux éditeurs aurait chance d'être plus tôt terminé. Mais, à cause de la longueur, de l'importance et de la diversité des matières, la composition et l'impression du Rituel demandaient du soin et du temps. Aussi bien, le travail commencé en avril, peut-être en mai 1702, ne fut-il terminé que le 31 mars 1703. La veille, le *Privilège du Roi* avait été enregistré sur le livre de la *Communauté des Imprimeurs et Libraires* de Paris.

Dans sa reliure originale, plein cuir avec ornements d'or, ce volume, grand in-octavo, aurait eu vraiment belle apparence si l'on n'y avait pas ajouté les Statuts et Ordonnances qui l'alourdissent quelque peu.

A part les six premiers feuillets qui comprennent la garde, le titre, la lettre-préface et la liste des fêtes du diocèse de Québec, le

[1] Statuts et Ordonnances, publiés avec le Rituel, p. 82. Si l'on en croit un document que nous citerons plus loin, quelques-uns de ces statuts étaient déjà imprimés avant qu'ils ne fussent soumis à l'examen et à la discussion du clergé.

Rituel proprement dit, avec les tables et quelques appendices, contient 604 pages, suivies de six autres non paginées dont deux pour une *Table d'examen de conscience*, deux et demie pour les *Errata*, et le reste en blanc.

Entre le titre proprement dit et le nom et l'adresse de l'éditeur, se trouve une jolie gravure en taille-douce représentant les armes du diocèse de Québec. En tête du feuillet suivant, avant la lettre-préface, une vignette gravée sur bois reproduit les mêmes armes entourées d'un élégant dessin. Le volume mesure huit pouces et demi sur cinq et demi. Voici le titre de la première édition:

"RITUEL DU DIOCESE DE QUEBEC, PUBLIE PAR L'ORDRE DE MONSEIGNEUR DE SAINT-VALIER EVEQUE DE QUEBEC A PARIS, CHEZ SIMON LANGLOIS, RUE SAINT ETIENNE DES GRES AU BON PASTEUR MDCCIII AVEC PRIVILEGE DU ROI.

A la suite du Rituel ont été ajoutés les statuts et ordonnances dont voici le titre:

"STATUTS ORDONNANCES ET LETTRES PASTORALES DE MONSEIGNEUR DE SAINT-VALIER EVEQUE DE QUEBEC POUR LE REGLEMENT DE SON DIOCESE."

Le titre, la vignette, le nom et l'adresse du libraire comme pour le Rituel.

Cette édition du Rituel que nous venons de décrire est la première; c'est celle dont nous allons nous occuper pour le moment. Quant à la seconde, qui porte, elle aussi, la date de 1703, elle a certainement été imprimée plus tard; il en sera question à la fin de ce travail.

L'impression et la reliure de son Rituel étant terminées, Mgr de Saint-Vallier distribua quelques exemplaires de son livre à des amis de France et en envoya aussi quelques-uns au Canada par les premiers vaisseaux de 1703. Il se réservait, comme il l'avait promis, d'emporter le reste lorsqu'il reviendrait au pays. Ce ne fut qu'au printemps de 1704 qu'il pût se mettre en route pour son diocèse. Vers la fin de juin probablement, il s'embarquait sur *La Seine* chargée d'une cargaison considérable au milieu de laquelle se trouvait le précieux rituel.

Le 26 juillet (1704), le vaisseau fut pris par les Anglais. Mgr de Saint-Vallier, fait prisonnier avec les vingt-six ecclésiastiques qui l'accompagnaient, fut retenu en Angleterre durant cinq ans. Quant à la cargaison, y compris le Rituel, elle fut vendue pour la somme de treize cent mille livres.[1] Quel profit l'Angleterre a-t-elle

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[1] L'abbé Auguste H. Gosselin, *L'Eglise du Canada sous Mgr de Saint-Vallier*, p. 63.

pu tirer de l'ouvrage de Mgr de Saint-Vallier ? C'est ce que nous serions curieux de savoir.

Quoi qu'il en soit, il ne resta de cette première édition que les rares exemplaires qui avaient été distribués en France ou envoyés en Canada.

L'Université Laval possède l'un de ces précieux exemplaires probablement donné par l'évêque de Québec à l'un de ses amis de France. C'est celui de Mgr Godets-Desmarest, évêque de Chartres. Ce beau volume, légué au Séminaire de Québec par l'abbé Edouard Plante, est dans sa reliure originale et porte sur les plats, gravées en or, les armes de Mgr Desmarest[1]. A l'intérieur de la couverture, on peut lire ce qui suit: "*Libro assai raro per essere naufragata la nave che ne portava gli esemplari al Canada.* Livre très rare, le vaisseau qui en portait les exemplaires en Canada ayant fait naufrage! Pour dire la vérité, le vaisseau ne fit pas naufrage; il fut pris par les Anglais, mais le résultat, quant au rituel, fut à peu près le même, c'est-à-dire une perte totale.

Les exemplaires envoyés en Canada par Mgr de Saint-Vallier ne furent pas nombreux, croyons-nous. Nous en connaissons cependant quelques-uns et l'Université Laval en possède deux de cette édition.

Comment le *Rituel de Québec* fut-il accueilli par l'ensemble du clergé tant régulier que séculier ? Nous n'en savons rien. Mais ce dont nous sommes certain, par exemple, c'est que des particuliers ne se gênèrent pas de le critiquer. L'un d'eux, le Père Bouvart, Jésuite, fit mieux; il mit ses observations par écrit. Nous avons sous les yeux une copie très ancienne de ce travail; elle est conservée aux archives du Séminaire de Québec.

Ce manuscrit comprend cinquante-deux pages in-octavo carré. Trente-cinq pages sont consacrées à la critique du rituel, trois aux statuts et ordonnances, huit à des fautes moins importantes du rituel, et, enfin, deux et demie au catéchisme. Le reste appartient à la couverture.

Voici le titre général que porte ce manuscrit:

Critique du P. Bouvart Religieux de la Compagnie de Jésus sur le Rituel et le Catéchisme de Monseigneur l'Evêque de Québec, et la censure de la dite Critique faite par les Docteurs de Sorbonne.

Indépendamment de sa valeur intrinsèque, ce document est important. Il sert à prouver très clairement que l'édition dont nous avons parlé plus haut est bien la première, puisque l'on re-

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[1] Né en 1647, mort en 1709. Evêque de Chartres en 1690.

trouve dans l'autre presque toutes les corrections suggérées par le Père Bouvart.[1]

Nous allons voir que Mgr de Saint-Vallier fut loin d'être content de ces remarques.

Les exemplaires envoyés à Québec par le prélat lui-même ou par d'autres personnages, durent arriver en juin ou juillet. (1703). Ceux à qui ils avaient été adressés eurent par conséquent le loisir d'examiner l'ouvrage et d'en faire la critique avant le départ des derniers vaisseaux, à l'automme. C'est ce que fit le Père Bouvart.

Homme pacifique et conciliant[1], le bon religieux se crut-il obligé cependant de donner son avis et de faire parvenir ses remarques et ses observations à Mgr de Saint-Vallier ? Se contenta-t-il de les envoyer en France à ses supérieurs ou à des amis ? Avait-il plutôt communiqué cette critique à quelque personne du pays qui en aurait fait tenir une copie à l'évêque de Québec ? Autant de questions auxquelles il nous est impossible de répondre, n'ayant rien pu trouver à ce sujet.[3]

Ce qui ne fait aucun doute c'est que Mgr de Saint-Vallier fut profondément blessé de ces remarques et que, sans tarder, il soumit la critique du Père Bouvart à la censure de la Sorbonne. Celle-ci ne fit pas trop attendre sa réponse; elle est raide et cassante. L'auteur de la critique n'y est pas ménagé. Sans doute, les docteurs de Sorbonne réfutent victorieusement certaines objections du P. Bouvart, mais il leur arrive parfois, lorsqu'ils ne savent plus que répondre, de prendre la tangente ou de se servir de gros mots qui cachent mal leur embarras. Pour dire la vérité, les critiques du P. Bouvart portaient juste, le plus souvent. Et la preuve, c'est que, malgré les explications des Messieurs de la Sorbonne, malgré leurs indignations, leurs sarcasmes ou leurs dédains, Mgr de Saint-Vallier se crut obligé de tenir compte de presque toutes les remarques du critique dans la seconde édition de son Rituel.

Personne ne se scandalisera, nous l'espérons, de ce qui va suivre. Le Père Bouvart ne s'attaque ni à la personne de son évêque ni à son autorité. Sa critique n'a pour but que de remettre au point certaines affirmations, certains détails qui pouvaient prêter à discussion. En sa qualité de professuer de théologie, il crut probable-

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[1] Ancien professeur de rhétorique, de philosophie et de théologie, le P. Bouvart était devenu Supérieur de toutes les missions en 1698, charge qu'il occupa jusqu'au mois d'août 1704. (Cf. Rochemonteix: *Les Jésuites et la Nouvelle-France au XVIIe siècle*, III. pp. 294, 373.)

[2] Rochemonteix. *oper. .cit*, p. 373.

[3] Monseigneur de Saint-Vallier aurait-il lui-même sollicité une expression d'opinion de la part du P. Bouvart qu'il connaissait bien ? C'est possible. Mais alors pourquoi s'en serait-il offensé ?

ment qu'il lui serait permis de donner son avis sur une matière aussi importante et il le fit simplement, mais franchement.

Le Père Bouvart intitule ainsi son travail:

"*Critique du N.N.* (*lisez: le Père Bouvart*) *du Rituel et du Catéchisme que Mgr de Québec a fait imprimer en 1702* (*sic*) *pour l'usage de son diocèse.*"

Les réponses à la critique sont placées sur la page qui fait face à celle-ci. Elles portent pour titre: "*Censure de la Critique faite par les Docteurs de Sorbonne en l'année 1704.*"

"Dans la lettre qui sert de préface, écrit aussitôt le Père Bouvart, Il (Mgr de Saint-Vallier) promet des règles sûres et des maximes uniformes. Cependant ce livre n'est pas sans erreurs et contradictions."

La Sorbonne répond:

"Les Docteurs de la Sacrée Faculté de théologie de Paris soubssignés estiment que le Rituel de Québec est très orthodoxe dans tous les endroits qu'on a relevés et critiqués mal à propos dans l'écrit ci-joint, que cette critique est téméraire, scandaleuse, tendante au schisme et à la révolte des ouailles contre le pasteur et très injurieuse à Mgr l'évêque de Québec qui y est indignement traité, et très injustement rendu suspect de Pélagianisme, Luthéranisme, Calvinisme, Jeansénisme &."

Le P. Bouvart s'attaque tout d'abord à la liste des fêtes mobiles et immobiles que Mgr de Saint-Vallier avait placée au commencement du volume. "Dans la liste des fêtes mobiles, dit-il, il met celle du patron principal des paroisses quoiqu'elle se célèbre en son propre jour, par exemple, la St Pierre et St Paul, le 29 juin, la St Laurens le 10e août, la St. Charles, le 4 novembre &.

"Au contraire, il met parmi les fêtes immobiles celle de la Ste Famille, le 3e dimanche après Pâques; celle de la dédicace de l'église, le 2e dimanche de juillet, des Sts martyrs Flavien et Félicité, le premier dimanche de septembre, et celle de Notre-Dame de la victoire[1], le dimanche le plus proche du 22 octobre. Cependant, toutes ces quatre fêtes sont mobiles et la première l'est autant que le jour de Pâques.

"Au mois de février et de mars, Mgr met la Purification et l'Annonciation de Iere classe; on doute qu'il en ait le pouvoir.

"Dans le mois d'août, il ne met St Louis que comme second titulaire de la cathédrale et il est au moins autant Ier que la Conception."

"Selon lui, St. Marc n'étant pas fêté, il ne laisse pas que de mettre

[1] Fête instituée par l'évêque après l'attaque infructeuse des Anglais contre Québec, en 1690.

que cette fête arrivant dans l'octave de Pâques, la procession et l'abstinence sont renvoyées au lundi d'après la Quasimodo quoique la fête soit tranférée à un autre jour. Il a dû dire l'office et non pas la fête. De plus, si St. Marc est le jour de Quasimodo, l'abstinence et la procession seront-elles aussi renvoyées au lundi. ?"

Voici les réponses que la Sorbonne fait à ces remarques: "Outre que ces points ne regardent pas la doctrine, et que Mgr l'évêque n'a pas été obligé de suivre l'idée du critique, le Rituel de Québec est conforme en ce point aux autres rituels, entre autres à celui de Paris donné par Mgr le Cardinal de Noailles, et à ceux de Rheims, de Soissons, d'Amiens, de Verdun, de Léon &, lesquels mettent la fête du patron au rang des fêtes mobiles, parce qu'elle n'est pas le même jour dans toutes les paroisses.

"Les Evêques dans le diocèse desquels on suit le bréviaire romain, sont dans la possession et l'usage de rendre plus ou moins solennelles les fêtes selon la dévotion des peuples, et on en a plusieurs exemples dans le Royaume de France. Il est à la liberté de l'évêque de ne donner qu'un titulaire à son église, et lorsqu'il lui en donnera deux, il peut prescrire que l'un sera le premier et l'autre le second.

"Cette observation sur la fête de St. Marc est utile parce qu'il y a distinction entre une fête gardée ou chomée et non gardée."

La réponse de ces Messieurs n'était pas sans réplique. Mgr de Saint-Vallier le sentit bien. Aussi, malgré l'approbation de la Faculté et "bien qu'il ne fût pas obligé de suivre l'idée du critique," il fit placer, dans la seconde édition, la fête du patron principal parmi les fêtes immobiles. La Purification et L'Annonciation passèrent au rang des fêtes de seconde classe et l'on tint compte de la remarque du P. Bouvart au sujet de la St. Marc. Quant aux titulaires de la cathédrale, Mgr. de Québec maintint sa distinction: la Conception devant rester le premier et Saint Louis le second.

De la liste des fêtes, le critique passe au chapitre des sacrements.

"Dans la forme du baptême, écrit-il, il omet la particule *et* avant les mots: du Fils et du St. Esprit. On ne croit pas qu'il soit plus licite d'y omettre cet *et* que d'omettre *l'enim* dans la formule de la consécration à la messe. Ajoutez qu'on peut donner un sens arien à cette formule en l'expliquant ainsi: Je te baptise au nom de Celui qui est Père du Fils &. Or, quoique dans la suite du rituel l'*et* ne soit pas oublié, il n'eut pas dû non plus l'omettre ici."

"Cette remarque, s'écrient les Docteurs, paraît de mauvaise foi, car le rituel marquant la forme du baptême page 14 et la manière de l'administrer pages 41 et 62, dit expressément qu'il faut dire: In nomine Patris et Filii et Spiritus sancti, amen, ce qui est répété huit fois aux différents endroits des instructions du baptême

et de la manière de l'administrer, d'où il s'ensuit que c'est ici une omission de l'imprimeur."

La Sorbonne avait certainement raison, le mot *et* avait été oublié; il fut ajouté dans la seconde édition.

Le Père Bouvart continue: "Où (Mgr) trouve-t-il ce qu'il fait dire à St-Pierre, page 4, à savoir que la grâce sanctifiante est le premier des dons de Dieu ? Les Pélagiens pouvaient peut-être parler de la sorte, mais un catholique doit reconnaître que dans les adultes, la grâce actuelle, la foi et l'espérance sont des dons divins qui précèdent celui de la grâce sanctifiante."

"Le critique ne sait pas, retorquent ces Messieurs, que la grâce par laquelle le péché mortel est effacé est appelée la première grâce pour bien des raisons qu'il peut apprendre des théologiens et que, selon le rituel, elle est la première en dignité ainsi qu'il paraît par la lecture du livre."

Et l'on peut lire dans la seconde édition: "Cette grâce sanctifiante est le premier des dons de Dieu *en dignité*."

Un peu plus loin, Mgr de Québec ayant dit que "Dieu donne ordinairement les grâces actuelles à ceux qui reçoivent les sacrements en des bonnes dispositions," le critique lui fait observer que si l'on ne veut pas tomber dans le jansénisme, il faut dire toujours et non pas ordinairement.

"Il est faux, répondent les théologiens de la Sorbonne, que les grâces actuelles propres aux sacrements soient toujours accordées à ceux qui reçoivent la grâce sanctifiante. Suarez, dans la 3me partie, parlant des effets de l'eucharistie a enseigné sans être janséniste que tous ceux qui communient, quoiqu'ils reçoivent la grâce sanctifiante, ne reçoivent pas toujours la grâce sacramentelle et les secours actuels pour lesquels ce sacrement a été institué, parce que souvent, ils y mettent obstacle par leur attache au péché véniel."

Malgré cette explication victorieuse, l'auteur du Rituel écrivit tout simplement dans sa seconde édition: "Ces grâces sont de deux sortes, les unes sont pensées surnaturelles dans l'entendement et les autres affections et mouvements que Dieu donne à ceux qui reçoivent les sacrement avec les dispositions nécessaires."

Enumérant, à la page 9, les personnes à qui l'on ne doit pas administrer les sacrements, le prélat terminait sa liste par celles qui sont "en occasion de péché mortel."

Le Père Bouvart s'étonne que l'auteur n'ait pas distingué entre occasion et occasion, par exemple "si elle est prochaine ou même morale ou si elle n'est pas telle, ce qui peut être cause à plusieurs prêtres de faire bien des fautes et de scandaliser bien des personnes par une rigueur outrée."

"Mais, répond la Faculté, l'occasion du péché pour laquelle il faut refuser les sacrements est marquée page 96 où il est dit expressément qu'elle doit être prochaine, et il n'est pas nécessaire qu'un auteur qui s'explique suffisamment à un endroit, s'explique dans tous les autres, autrement, son ouvrage serait plein de redites."

Cette explication un peu faible ne donna pas satisfaction à Mgr de Saint-Vallier sans doute, car dans la seconde édition, il fit imprimer: "occasion prochaine."

"Il est dit page 24, continue le critique, que l'église *commande* que l'on donne un nom de saint ou de sainte à chacun selon son sexe. On peut conseiller cette pratique, mais où est le commandement? Sur quoi aussi est fondé l'ordre qu'il donne de ne point admettre pour parrains des garçons de 14 ans et pour marraines des filles de 12 ans, si les uns et les autres n'ont pas été confirmés. Car, s'il n'y a point de leur faute ou de leurs parents, pourquoi leur faire l'affront de les refuser vu que, dans le diocèse de Québec, il y a plusieurs paroisses comme à l'Acadie et à Plaisance où il y a plus de 14 ans que le prélat n'y a point paru."[1]

A ces objections, la Sorbonne répond que "le Rituel de Québec est conforme en ce point (les noms à donner aux enfants), à tous les autres rituels qui non-seulement conseillent mais défendent expressément de donner au baptême d'autres noms que des saints et des saintes, en sorte que le pontifical romain marque dans la confirmation que l'on changera le nom de ceux et celles qui se présenteront lorsqu'il n'est pas de quelque saint ou de quelque sainte."

"Pour ce qui est des parrains, disent plus loin ces Messieurs, la loi est bonne et raisonnable, mais, dans le cas de nécessité, elle souffre explication aussi bien que toutes les lois humaines."

Une fois de plus, Mgr. de Saint-Vallier tint compte de la remarque du Père Bouvart et, dans la seconde édition il fit imprimer: "l'église *désirant* au lieu de *commandant*."[2] Pour ce qui concernait les parrains et les marraines, il ajouta: "ou qui, par leur faute, n'auraient pas reçu le sacrement de confirmation."

Le Père Bouvart et les Docteurs de Sorbonne continuent ainsi assez longuement. Le premier signale ce qu'il croit des erreurs, relève des contradictions &; ces Messieurs se défendent en invoquant les théologiens, les conciles, et surtout la coutume de France. Ils traitent parfois le pauvre Père assez rudement. "Les réflexions du critique ne sont pas pardonnables," disent-ils quelque part. Et

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[1] La visite pastorale dont il est ici question eut lieu en 1689. Mgr de Saint-Vallier partit au commencement de mai et ne revint à Québec que tard dans l'automme. (Cf. L'abbé Aug. H. Gosselin: *L'Eglise du Canada sous Mgr de Saint-Vallier*, pp. 63 et suiv.)

[2] Nous prions le lecteur de remarquer que c'est toujours nous qui soulignons.

plus loin: "Cette critique est si évidemment déraisonnable et maligne qu'on y doit répondre qu'en la méprisant." Ils dédaignent de considérer certaines remarques, de réfuter certaines objections qu'ils jugent puériles: "Les réflexions du critique sont vaines comme celles sur la page précédente et ne méritent aucune réponse." Ou encore: "Il n'y a qu'un homme aveuglé par la passion et qui voulant rendre ridicule son ennemi ne voit pas que par le terme *un coin* est signifié un endroit écarté et moins fréquenté." Mgr avait dit qu'après la communion, on doit se retirer dans *un coin* de l'église et le Père avait fait remarquer que si l'on *devait* faire cela," les coins de l'église seraient bien pleins les jours de grandes fêtes." Il faut avouer que le Père était un peu pointilleux. Mais la preuve que les critiques ne portaient pas toujours à faux, comme bien des réponses tendent à le faire supposer, c'est que l'évêque de Québec finit par tenir compte d'un bon nombre des remarques de son contradicteur et qu'il corrigea son ouvrage en conséquence. Et cela est suffisant pour démontrer l'à-propos de cette critique.

Les extraits que nous avons donnés plus haut font assez connaître le travail du Père Bouvart et celui de la Sorbonne. Nous pourrions nous arrêter ici. Le lecteur nous permettra cependant de lui communiquer les dernières observations de l'auteur de la critique: elles sont un peu longues, mais elles ne manquent pas d'un certain intérêt.

"Je finis, dit-il, l'examen de tout ce livre par deux remarques: la première qu'on a pu faire déjà sur la page 601 et les suivantes[1] et qu'on pourra faire encore dans les pages 175, 368 et autres, comme dans les réglements et statuts . . . c'est qu'il est plus opposé que favorable aux religieux auxquels il ôte autant qu'il peut leurs privilèges.

"La seconde réflexion est que quoique dans la spéculation et en parlant en général il autorise la confession fréquente et la fréquente communion, il les ôte en effet par les difficultés qu'il y met dans la pratique et desquelles nous avons parlé dans cet écrit.

"Un de mes amis à qui je lisais ce recueil de remarques, me reprocha que j'y passais bien des choses, entre autres l'article dont il est tant parlé dans le rituel et les règlements au sujet des billets pour la confession de Pâques."

"J'y ai observé, lui dis-je, qu'il s'y contredit lui-même, car dans le Rituel, p. 162, il dit aux curés: Si vous accordez la permission de se confesser à d'autres (ce qui marque de la difficulté à le permettre) vous devez leur donner un billet portant les noms du pénitent, du curé, du confesseur, et le pénitent sera obligé de rapporter un certificat

[1] Dans ces pages se trouvent des décrets restreignant ou révoquant les privilèges accordés aux religieux.

qu'il s'est confessé sans lequel vous ne l'admettrez point à la communion, au lieu que, dans les règlements, p. 117, il déclare qu'il est nécessaire que les curés soient faciles à donner des billets ou permissions de se confesser à d'autres et qu'il leur donne le choix de plusieurs, et dans la page 108 il ordonne que les pénitents rapportent à leur curé un billet du dit confesseur.

Il dit même de bouche dans son synode de 1700 que le billet se donnerait même aux non absous."—Mon ami reprit: Je trouve plus de difficultés ici que de contradiction. Sans parler de l'embarras que les billets exigés du confesseur lui causera, s'il a foule de pénitents, les pénitents dont il s'agit ne veulent-ils point être inconnus ? Et si l'on sait leur nom, n'en sera-ce pas assez pour leur faire celer leurs crimes ? A cet inconvénient j'en joins un autre qui viole à mon avis le secret de la confession. Car y ayant dans le diocèse de Québec plusieurs cas réservés dont peu de confesseurs puissent absoudre, un curé trop curieux et trop peu scrupuleux adressera justement ses paroissiens à un confesseur qui n'a pas les cas réservés pour juger s'ils en ont par le refus qui leur sera fait de l'absolution.

Il faudrait donc pour empêcher le mal que tous les confesseurs, dans la quinzaine de Pâques, eussent les cas réservés et que les pénitents eussent la liberté de choisir entre trois ou quatre confesseurs qui leur plairaient si tant est qu'on les gênât là-dessus. Pour ce qui est de leur donner un billet qu'on les a confessés, je ne vois pas qu'on le puisse licitement, à moins qu'on ne les ait absous, puisque, surtout si ce sont des femmes et des filles, c'est les mettre en danger de faire des communions sacrilèges. Car de dix qui auront eu des billets de leurs confesseurs sans en avoir l'absolution, je trouve qu'il s'en trouve une seule qui avoue à son curé qu'elle a besoin d'aller à un nouveau confesseur et les neuf autres sont pour se présenter en mauvais état à la Ste. Table. Ce qui étant ainsi qu'il est, si Mgr de Québec persiste dans son opinion au sujet des confessions paschales, je lui en quitte ma part et je prends le temps de Pâques pour faire ma retraite annuelle où je prierai pour Sa Grandeur.

"Mais Sa Grandeur, lui répliquai-je, s'autorise sur la pratique des Jésuites qui exigent de leurs écoliers des billets de confession.

"C'est bien la même chose, reprit-il; Ces écoliers se choisissent eux-mêmes un confesseur parmi tous les pères et même ailleurs s'ils veulent en demander la permission. Ces écoliers, s'ils veulent être inconnus, donnent leur nom dans un billet cacheté sur lequel ils marquent seulement la classe dont ils sont, et les confesseurs, au sortir de l'église, mettent ces billets qu'ils ont eus dans un sac ou dans une boîte et les régents les y vont prendre.

"De plus, les écoliers ne sont pas obligés de communier lorsqu'ils

donnent des billets jusque là qu'on n'en exige point, ni le mois de Pâques, ni quand ils sont de la Congrégation. Ce n'est pas tout. Si ces écoliers ne sont pas disposés suffisamment pour recevoir l'absolution et qu'ils veulent se soumettre à ce que leur confesseur leur prescrit, il ne laisse pas de prendre leur billet; mais le refuse s'ils ne veulent pas se soumettre à ses ordres et à ses avis. Que les personnes qui exigent des billets de confession les exigent avec les mêmes ou de semblables conditions et précautions et j'y tanperai (sic) obtempérerai.

"Je suis assez de votre avis, lui dis-je.

"Je crois, me répondit-il que vous en serez encore au sujet des quatre synodes que Mgr. de Québec prétend avoir tenus en 1690, 1694, 1698 et 1700 à savoir que ces assemblées n'ont point été des synodes, puisque, sans y demander les avis des assistants, il y a apporté des statuts tout écrits ou même imprimés.

"Je vois bien votre pensée. Comme il a été tout seul son synode et son conseil, vous voulez que Sa Grandeur ait seule la gloire de ce qu'il y a eu de bon et que son clergé n'ait point le blâme de ce qu'il peut y avoir de blâmable."

Cette conversation vraie ou supposée nous apprend deux choses: en quoi consistait le système des billets de confession au collége des Jésuites et comment se sont tenus les quatre premiers synodes de Québec. Pour ce qui concerne ces derniers, l'affirmation de l'interlocuteur qui paraît avoir été présent à ces réunions, est très catégorique: Mgr. de Saint-Vallier y apporte "des statuts tout écrits et même imprimés." Et c'est ainsi que M. Tremblay peut être excusable d'avoir cru et dit en 1696 que le prélat faisait alors "imprimer toutes ces choses. "Il n'est donc pas impossible que les Statuts et Ordonnances bien que portant la même date que le Rituel aient été imprimés avant celui-ci. La date et le fait que les Statuts ont été reliés avec le Rituel ne prouvent rien ici. La seconde édition de cet ouvrage servira à corroborer notre avancé.

Cette seconde édition, qui porte, elle aussi, la date de 1703, n'est pas, comme quelques-uns l'ont cru, une reproduction exacte de la première. C'est bien une nouvelle édition revue et corrigée sinon augmentée. Les corrections seules suffiraient à le prouver. Au reste, les caractères, la pagination, la disposition des matières ne sont pas les mêmes que dans l'autre. Le titre lui-même a été modifié. On n'y voit plus le nom de *Monseigneur de Saint-Vallier*, comme on l'avait fait d'abord imprimer: on remplace ces mots par *Monseigneur l'Evêque de Québec*. Et c'est par là surtout que l'on peut aisément et d'un simple coup d'oeil distinguer cette seconde édition de la première.[1]

[1] M. Philéas Gagnon indique parfaitement les deux éditions dans son *Essai de Bibliographie canadienne*, Québec, 1895, p. 437.

Comment expliquer que ces éditions différentes, sorties de chez le même libraire, soient toutes deux de 1703 ? Personne ne prétendra que la première ait été épuisée en si peu de temps. En effet, et il n'y a qu'une supposition qui nous paraisse plausible, c'est que cette nouvelle édition étant destinée à remplacer l'autre, disparue en bloc, le prélat crut devoir y mettre la même date. Mais, en réalité, elle n'est pas et ne peut pas être de 1703, puisque celle qu'elle devait remplacer ne tomba aux mains des Anglais que le 26 juillet 1704.

Mgr de Saint-Vallier, retenu en Angleterre durant cinq années, attendit-il son retour en France pour faire réimprimer son Rituel ? C'est possible, mais nous en doutons. Il est plus naturel de croire qu'après avoir fait les corrections qu'il jugea à propos il chargea une personne de confiance, un ami, de surveiller cette nouvelle impression qu'il envoya en Canada le plus tôt possible ou qu'il apporta lui-même en 1713. C'est cette dernière édition qui fut répandue dans l'immense diocèse qu'était alors celui de Québec et qui a été si longtemps à l'usage du clergé canadien.

Le Rituel de Mgr. de Saint-Vallier a donc fait un beau règne. Malgré les critiques justes ou injustes du Père Bouvart, il méritait l'estime et la faveur dont il a joui durant près de cent cinquante ans et nous sommes convaincu que ceux qui ont la bonne fortune d'en posséder un exemplaire le conserveront précieusement non-seulement en souvenir du pieux et zélé second évêque de Québec, mais à cause de sa valeur intrinsèque.

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SECTION II

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An Organization of the Scientific Investigation of the Indian Place-nomenclature of the Maritime Provinces of Canada.

(Fourth Paper).

By W. F. GANONG, M.A., Ph.D.

(Read by Title May 27, 1914.)

This paper is identical in aim and method with its three predecessors, which were published in the immediately foregoing volumes of these Transactions. In a word, I am trying to apply the principles of scientific analysis to a very interesting subject especially prone to doubt and error. The comparative method which I use, explained in the introduction to the first paper, is proving wonderfully successful in solving the problems, as this paper will further illustrate.

For convenience of reference I may add that the former papers made analysis of the names Oromocto, Magaguadavic, Upsalquitch, Manan, Nepisiguit, Kouchibouguac, Anagance, Wagan, Pokiok, Penniac, Bocabec, Pentagoet-Penobscot, Pohenegamook, and Cobscook, and used the roots thus made available in the analysis of a good many other words, both existent and extinct, of lesser importance. Of these extinct Indian names,—indigenous to the country, appropriate to the places, and often reducible to a highly pleasing form, —the greater number may be revived to obvious advantage when additional place-names become needed in future; and I have tried to suggest simplified and softened forms for such purpose.

As to pronunciation, I have myself used, as a rule, only the ordinary English sounds of the letters, in order that the reader may be able to understand the words without constant resort to special keys. All of Rand's words, from his *Reader* and two *Dictionaries*, use pronunciation signs which are identical with those of our English Dictionaries, excepting that in his *Micmac-English Dictionary* his editor uses the letters *tc* to express the soft sound of *ch* in church.

Gatschet and M. Chamberlain both use the standard alphabet of philologists, in which the vowels are sounded for the most part in the continental manner. All of the words from Father Rasle's *Dictionary* are to be read as French.

Canso.

LOCATION AND APPLICATION.—The name of a Harbour, an important fishing center, at the extreme eastern end of the peninsular part of Nova Scotia; also a Cape on an Island south of the entrance to the Habour; also a Town on the southwest shore of the Harbour; also the Strait, or Gut, which separates the Island of Cape Breton from the mainland of Nova Scotia; also formerly applied by the French to the Bay now called Chedabucto Bay. Its spelling, CANSO, expresses precisely its local pronunciation, the A being short, the O long, and the accent on the first syllable.

HISTORY OF THE NAME.—It makes its first known appearance in 1609 in the *Histoire de la Nouvelle France* of Lescarbot, where it occurs many times and always in the form CAMPSEAU, applied especially to the Harbour, but also to the Bay which we now call Chedabucto Bay, and to the Strait. As to the Strait, Lescarbot uses in the explanation to his map this expression,—"Passage or Strait of the Bay of Campseau," showing that the name did not belong originally to the Strait but was applied thereto descriptively because it communicated with the Bay of Campseau. The name next appears in Champlain's *Voyages*, of 1613, first in the form CANCEAU, which spelling is used also on his map; but later, and oftener, as CAMPSEAU. He applies the name, however, only to the Harbour, while he leaves the Bay unnamed, and gives two different names to the Strait,—or Passage, as the French called it. In a later edition of his works, in 1632, and upon his map of that year, he uses the form CANCEAU for Harbour and Passage, and CAMPSEAU for the Bay. Both Champlain and Lescarbot show that the Harbour was a place of resort for fishermen, implying that the name had already been previously in use. Father Biard, in his *Relation*, uses CAMPSEAU and CAMPSEAUX. De Laet, who follows Champlain closely in most matters, adopts CAMSEAU for the Harbour, on his map of 1630; Creuxius, on his map of 1664 in his *Historia Canadensis* uses the Latinized form CAMPSEIUM for both Port and Strait; Denys, who knew this region well, and describes it fully in his well known *Description....de l'Amerique septentrionale*, of 1672, applies the name CAMPSEAUX to Port, Bay, and Passage, though on his map the Baye is confused with the Port by the engraver. With Denys, however, the use of the name for the Bay disappears. The published map of Canada by Du Val of 1677 uses CAMSEAU for the Passage and CANZEAU for the Port; Jumeau, in his fine map of 1685 (published in the Champlain Society's edition of Father le Clercq's *New Relation of Gaspesia*, 10) has CANCEAU, but applied only to the Cape, while the great De Meulles-Franquelin map of Acadia, of 1686, still unpublished, has CAMCEAUX for the Cape, though the Passage here bears its temporary name of Fronsac, which appears also upon some later French maps. Naturally the later maps by Franquelin, of which several exist in Ms., have the form CAMSEAU, which appears also on the fine map of Canada by De l'Isle of 1703. With this map and those that it influenced, however, the M disappeared, to be replaced by N, for Bellin, in his very influential and widely-copied map of Acadia of 1744, in Charlevoix's *Historie de la Nouvelle France*, adopted CANCEAU, and his authority soon made this the prevailing form upon all of the later French maps. In thus abandoning the

earlier CAMCEAU for CANCEAU Bellin may have been influenced by the occurrence of this form on Champlain's maps; but it is much more likely that he reflected therein the established pronunciation, which by this time had settled upon the N sound after a long period of vacillation between M and N. This receives confirmation from the early adoption of the N upon English maps, the earliest that I find being Moll's of 1715, which applies the form CANSEAUX to the Strait. This soon became simplified to CANSO, which I find first upon the Morris map of 1749 published with *The Journal of Captain William Pote*, (New York, 1896). Morris applies the name to the Cape, to Islands in the vicinity, and to the Strait. This form soon became prevalent upon the English maps, and finally attained to universal use, though with an occasional partial return to a French form, of which a conspicuous instance is found in Haliburton's *History of Nova Scotia*, of 1829, which uses CANSEAU. An early English corruption of the word was CANCER, used by Colonel Church in 1696 (Drake's *History of Philip's War*, 1827, 227).

Summarizing now the history of the word it seems plain, (1) it was in use before its earliest recorded appearance; (2) its early recorded forms were prevailingly CAMPSEAU and CAMSEAU, with CANCEAU as exceptional, though finally this form prevailed; (3) it was applied especially to the Harbour, from which it was apparently extended to the Bay, as it certainly was from the Bay to the Strait, its original use being thus apparently for the Harbour only. In a new country where place-names are scant, there is always a tendency to extend them to cover a number of features in their vicinity.

Analysis of the Word.—Lescarbot affirmed, in 1609, in the key to his map, that the word is Indian, and all evidence sustains his statement. Our best authority upon the Micmac language, Rev. S. T. Rand, gives the name in his works as Micmac, deriving it from CAMSŌK, to which he assigns the meaning, "Opposite a high bluff" (*First Reading Book in the Micmac Language*, 85), while elsewhere (*Micmac-English Dictionary, 183*) he gives with the spelling KAMSŌK, the meaning "Opposite the lofty cliffs." Again, Rev. Father Pacifique, another of our best authorities in Micmac, gives its aboriginal form as GAMSŎG (*Micmac Almanac* published in 1902), though he does not mention any meaning. With Rand's information to aid, it is easy to resolve the word into its roots, of which there are two. The first is obviously the inseparable prefix KAM, part of KAMĀĀK, meaning ACROSS, or BEYOND (Rand, *English-Micmac Dictionary*, 5, 36). This prefix occurs in a number of combinations meaning ACROSS, or ON THE OPPOSITE SIDE OF e.g., KAMESEBOO (K) meaning ACROSS, or ON THE OPPOSITE SIDE OF, THE RIVER, the root SEBOO meaning River, K being the locative, and the E after the M being simply separative for ease of pronunciation (*op. cit.* 5, 186). In these cases, as in all others given by Rand, the meaning is always across, beyond, or on the other side of, the object mentioned *from the speaker*, and not across from or opposite the object itself. It is to be noted, by the way, that the correctness of KAM as the first root is confirmed by the prevalence of M instead of N in the early forms of the name, as above recorded.

Turning now to the second part of the word KAMSŌK, that also is plain. It is an inseparable root SŌK, meaning BLUFF or CLIFF. Thus, Rand gives for CLIFF KĀKOOSŌK (*English-Micmac Dictionary*, 60), and gives 'MTĂSŌK' as PRECIPICE (*op. cit.*, 202); a CAVE is LAMSŌK (literally "inside a CLIFF," *op. cit.*, 53; *Micmac-English Dictionary*, 86), while the same root occurs in the place names, *KTADOOSŌK*, *SEVOGLE*, and others considered below. Placing now this root SŌK in place of SEBOO in the combination given above, we have KAM-SŌK, meaning ACROSS THE CLIFF or ON THE OPPOSITE SIDE OF THE CLIFF, or

BEYOND THE CLIFF (from the person speaking). There is no doubt, I believe, as to this meaning.

With the word KAM-SŌK, meaning BEYOND THE CLIFF, thus clear, we turn to examine the applicability of the word to the topography of CANSO. And this is not hard to find. The entire north coast of this part of Nova Scotia, from near Canso westward almost to Guysboro Harbour, is a well-nigh unbroken line of abrupt and striking bluffs and cliffs, making, indeed, almost a single cliff line for that distance. This line of cliffs, I have no question, is the SŌK of KAMSŌK. Now to one approaching, or speaking, from the direction of Guysboro and the Strait of Canso, the Harbour of Canso is the first place of any consequence beyond or on the opposite side of these cliffs, and as all of the evidence we possess would tend to show that Guysboro and the Strait, with the various places accessible therefrom, were the usual places of Indian resort, while the much less favored Canso was a place of occasional visit rather than permanent residence, the expression PLACE BEYOND THE CLIFFS would be a most natural and appropriate designation therefor. And this I believe to be the actual origin of this word. As in other cases the name was probably not applied to a particular spot but rather to the vicinity of the Indian camping grounds, which were probably on or near the present town of Canso.

This analysis of the roots of the name KAMSŌK brings out the fact that the word lacks the locative termination usually borne by aboriginal Micmac names to express the fact that the word applies to a place. We would expect, therefore, to find that the aboriginal form of the word would terminate with K, or CH, and a preceding vowel, in accordance with the usual mode of forming the locative. Now it happens, I believe, that this full locative form does actually survive, in the CAMSOGOOCH, next considered; and it seems most probable that the locative termination OOCH was dropped in the course of the long use of the word by fishermen and others prior to its appearance in records, although, as will be shown, it is still retained by the Indians.

Other Explanations of the Name.—Of these I have found four. L'Abbé Laverdière in his great *Oeuvres de Champlain*, 278, calls attention to a statement of Father F. Martin, in his translation of Father Bressani's *Relation*, to the effect that Canseau was named for a navigator named Canse. This explanation is given in Brown's *Yarmouth, Nova Scotia*, 1888, 34, with an addition,—"from the French Navigator Canse, and eau (water)"! But l'Abbé Laverdière shows conclusively that this derivation rests upon a mistaken reading of a passage in Thevet, who is really referring to the West Indies, while moreover the navigator's name is given by Thevet as Cause, not Canse. Again, Haliburton, in his *History of Nova Scotia*, II, 223, speaking of the Strait, has this note,—"It is said that the derivation of the word Canseau, is from the Spanish 'Ganso', a goose, a name given to it on account of the immense flocks of wild geese then seen there." No evidence of any sort is adduced in support of this view, nor do the records supply any; and it is obviously no more than one of those pure guesses based upon a similarity of word forms, such as are sufficiently common in this subject, and of which the most conspicuous example is Acadia (compare the references in the Champlain Society's edition of Denys' *Description*, 126, and a later number of this series). The third of the other explanations is that of Rouillard, in his *Noms Géographiques empruntès aux Langues Sauvages*, Quebec, 1906, 27. After discussion he rejects an Indian in favour of a French origin, deriving it from *Canseau*, and he quotes Réveillaud's *Histoire du Canada* as recalling that this word *Canseau*, or *Chanseau* in old French meant "Boundaries or Limits" ("bornes, limites"). No evidence, however, or reason, for such a meaning is offered, and this explanation evidently has no other foundation whatever than a chance

resemblance of words from different tongues. The fourth of the other explanations, rests, curiously enough, upon an error made by Rand himself. Thus, as noted above, he defines CAMSŌK as meaning "opposite a high bluff" and "opposite the lofty cliffs," while elsewhere he gives "high banks opposite," (*Micmac-English Dictionary*, 60); and in yet another place (*English-Micmac Dictionary*, 186), under the word "opposite," he writes, "A steep bluff is on the opposite side, KĂMSŌK. (Hence the pr.n. *Canso*)" Rand thus makes this word CAMSŌK mean a place across from a cliff, or opposite to a cliff, (i.e., facing a cliff) which is quite a different thing from a place across or beyond or on the opposite or other side of a cliff. But Rand's own works are the very best witnesses that here he has erred somewhat. As comparison of the data above given under the analysis of the word will show, all others, excepting CAMSŌK, of his several combinations involving the root CAM or KAM carry for this prefix the significance of across, beyond, or on the opposite side of the object mentioned, i.e., the object mentioned is between the place meant and the speaker. Furthermore, I cannot find in Rand's works any case whatever of the use of KAM in a combination involving the meaning of opposite to, or across from, or facing the object mentioned. It seems perfectly clear, therefore, that Rand in the case of CAMSŌK, has been misled by the different meanings that can go with the word "opposite." I infer that he, not having in mind the geographical relations of CANSO to the cliffs between that place and Guysboro, has read into his phrase "opposite side of," the meaning "opposite side from,"—a rather natural, but in this case, quite incorrect rendering; and this meaning once in his mind, it influenced all of his later treatment of the word. It is precisely this same meaning, doubtless obtained originally from Rand himself, which underlies Gesner's rather fanciful but widely copied phrase, "facing the frowning cliff" (Murdoch, *History of Nova Scotia*, I, 534).

SUMMARY. The name CANSO is of Micmac Indian origin, corrupted, through the French, from KAM-SŌK, or, probably in full form KAM-SŌK-OOCH, meaning literally BEYOND-CLIFF-PLACE, or, more freely, THE PLACE BEYOND THE CLIFFS, in description of its position in relation to the line of cliffs along the south side of Chedabucto Bay as considered from the direction of the more frequented country centering in Guysboro.

CAMSOGOOCH. A word given by Rand as the Micmac Indian name for "Little Canso" (*First Reading Book*, cited, 85, and *Micmac-English Dictionary*, 183, in the form KAMSŌKOOTC). The name "Little Canso" does not appear upon any map or chart that I can find. Its application, however, is made plain by information sent me by an interested and obliging resident of Canso, Mr. C. H. Whitman, who says that Canso, Cape Canso, and Little Canso, are all names for precisely the same place, in distinction from the Strait of Canso (which separates Cape Breton Island from the peninsula of Nova Scotia), but that the name Little Canso, used especially by American fishermen, is now rarely heard. This use of Little Canso is fully sustained by a statement in Haliburton's *History of Nova Scotia* (II, 93,) who shows that Little Canso was formerly used especially for the main entrance into Canso Harbour. Now Rand, it seems evident, not knowing this place personally, naturally assumed that CAMSOGOOCH and LITTLE CANSO are precise equivalents of one another and separate entirely from CAMSŌK and CANSO, whereas I take it that just as CANSO and LITTLE CANSO are identical, so are also CAMSŌK and CAMOSGOOCH. Also, a genuine "little Canso," consistent in every feature, does exist, as will be shown under the word CAMSO-GOOCH-ECH, next considered. But more important is the fact, that the termination CH, which was evidently taken by Rand as a form of the diminutive CHICH or CHEECH, is by no means necessarily

a diminutive, but simply a form of the locative, equivalent to OOK. This is shown by the use of OOCH, or OOCHK as a locative termination in words in which there can be no suspicion of a diminutive meaning, e.g., LUSTGOOCH (Restigouche), TAKUMEGOOCHK (Tatamagouche), and others which will be considered later in this series. This termination, by the way, appears to be especially common in words in which the syllable before it ends in a K or hard G sound; and it therefore appears to be a device to prevent the immediate succession of two K sounds. Taking everything together, accordingly, it seems to me clear that we have in CAMSO-GOOCH simply the full aboriginal form, including the locative termination, of CAM-SŌK (the G and K sounds being almost indistinguishable in Micmac) which, as noted above, lacks the locative termination. The explanation of the linking of CAMSOGOOCH to LITTLE CANSO by Rand seems to be perfectly understandable. Rand's interest in Micmac place-names was purely incidental to his general linguistic Micmac studies, and ample evidence in his writings shows that he gave no critical attention to place-names. It seems most probable that the Indians, influenced by their familiarity with the English form CANSO, gave him the exact equivalent, without the locative, in Micmac roots, viz., CAMSŌK or KAMSŌK, but at the same time gave him also the full Indian form with the locative, KAMSŌK-OOCH. In the thought that these were two separate words, and finding a LITTLE CANSO all ready at hand, he naturally interpreted KAMSŌGOOCH as an abbreviated diminutive (involving CHEECH), of KAMSŌK. But in this natural supposition he erred, as I think there is no doubt. Rand's CAMSOGOOCH, accordingly, which would be better written KAMSOKOOCH, does not mean LITTLE CANSO, but is the full aboriginal form, including the locative termination, of CANSO.

CAMSOGOOCHECH. A word given by Rand as the Micmac name for White Head (*First Reading Book*, cited, 102; *Micmac-English Dictionary*, in the form KAMSŌKOOTCĒTC, 183). The roots of the word are perfectly clear; they include CAMSOGOOCH, just considered, the full aboriginal form of Canso, together with the very common suffix CHECH or CHEECH, which always means LITTLE. The word, therefore, means exactly and literally LITTLE CANSO. As to the location of White Head, the place to which the name applies, the editor of Rand's *Micmac-English Dictionary* is certainly in error in placing it in "C.B.," (Cape Breton), since no such name occurs in that island so far as I can find after the most detailed search. On the other hand, the name White Head occurs thrice not far from Canso,—for a Cape on White Island about six miles south of Canso, for an Island just off Whitehaven some twelve miles southwest of Canso, and as the local equivalent for Whitehaven itself. The former, being only an exposed point on a barren island, would not be a place for Indian resort, while, moreover, the name White Head is used only upon some maps, the charts having White Point. White Head, the Island, is a barren, inhospitable place, unlikely, I am told, to have been an Indian resort. Whitehaven, however, offers Indian camp sites, and it lies in the near vicinity of that Port de Savelette which is mentioned by both Lescarbot and Champlain as an important French fishing station to which the Indians resorted. Of these three, Whitehaven would seem the more probable location of KAMSOKOOCHECH or LITTLE CANSO, although one would expect a location nearer Canso itself. No doubt the name applied especially to the place in that region chief in importance as an Indian resort. But that there was a KAMSOKOOCHECH or LITTLE CANSO separate from KAMSOKOOCH or CANSO proper, there seems no question.

The existence of this name is a strong confirmation of the correctness of the view that CAMSOGOOCH is simply the full aboriginal form of CAMSŌK, for were it a diminutive, as Rand seems to have thought, we would then have in CAMSOGOOCHECH the remarkable and anomalous feature of a double diminutive. It is this apparent though groundless need for explaining a double diminutive that has led the editor of Rand's *Micmac-English Dictionary* (183) to define KAMSŌKOOTĒTC as "little place opposite small cliffs." But I think the evidence above given fully shows that only a single diminutive is present.

CANSEAU. The name of a Point on the south side of the Harbour of Charlottetown, Prince Edward Island, as marked upon the modern maps. The earliest use of the word on the plans in the Land Office at Charlottetown, as I am informed by Mr. Thomas W. May of that office, occurs on one of 1781, where it is spelled CANSO, while on another of 1819, the name is applied in this form not only to the Point, but also to the Cove next to the southward thereof. The word, accordingly, would seem identical with the name CANSO, in Nova Scotia, already considered. Turning, now, to the geographical features of the place, they are such as to seem to confirm the identity not only in form but in meaning, for to one entering the Harbour of Charlottetown (and the nomenclature of Harbours and Rivers was given by our Indians with reference to entering or ascending the same), the Point and Cove lie just beyond the lines of low cliffs which occur upon both sides of the narrow entrance.

On the other hand there is some good presumptive evidence that the name did not belong aboriginally to this place, but was transferred here by an indirect method from CANSO in Nova Scotia. The first survey of the Island was the very accurate one by Captain Holland, made for the British Government in 1764-5, and it is known that the vessel assigned to aid him in the survey was named the CANCEAUX (Campbell, *History of Prince Edward Island*, 4). In an excellent address upon Holland's Survey by Hon. F. de St. C. Brecken, published in *The Daily Patriot*, at Charlottetown, June 26, 1899, it is stated that Holland spent most of the winter of 1764-5 near Fort Amherst, on the west side of the entrance to Charlottetown Harbour, and a letter of Holland's is quoted in which he refers to men who are "to remain on board of the Canceaux for the winter, which is now unrigged and laid up in a cove a mile distant from the fort, where she is entirely out of danger from the ice doing her the least harm by driving upon her when it breaks up in the spring;" and the author of the article adds the comment that this cove was Canseau Cove no doubt, which is in fact situated a mile from the old fort. Hence it seems clear that the Cove took its name from its association with this ship, and later became extended to the neighbouring Point, a wholly consistent and natural method of origination of place-names. As to the origin of the name of the ship, we have no positive knowledge, but as the word Canceaux does not occur anywhere excepting as the name of the place in Nova Scotia, it would seem tolerably certain that it was drawn from that place.

Other Aboriginal Place-names containing the root KAM, meaning BEYOND, of CANSO.

Of these I have found thus far but one, and that not a certainty, viz., KAMOURASKA.

KAMOURASKA. An important locality,—County, former Seigniory, Village, small River, and group of Islands, on the south shore of the River Saint Lawrence a hundred miles below Quebec. The name has had its present form since early times, for the Title of concession of the Seigniory in 1674 spells it as now (Bouchette, *Topographical Dictionary of Lower Canada*,) while the great Franquelin-de Meulles

map of 1686, as I find in my photograph from the original, has it CAMOURASKA, applied to the Islands. The word has every appearance of an Indian origin, on which assumption its form suggests naturally two roots, KAM and OURASKA, the latter, however, in view of the constant replacement of the Indian R by L in words adopted by the French, being necessarily OULASKA. On this theory, the prefix KAM would represent our root KAM, meaning BEYOND or ON THE OTHER SIDE OF, as discussed under Canso, making the word mean a place BEYOND OULASKA. As to the identity of OULASKA, I have no facts, and can only suggest that it is connected with the present Ouelle (River), which looks like a probable abbreviation of an aboriginal OUELESKA. In accordance with this theory, we would expect to find the Ouelle River below KAMOURASKA, since the Indians applied their nomenclature with reference to the ascent, not the descent, of rivers; and it is a very curious fact that the usually accurate Franquelin-de Meulles map really has the "Ouel" below Kamouraska, though in this it is of course quite wrong. However, if the word did not originate with the Indians of the lower river, but of the upper parts, then the expression BEYOND OULASKA, or BEYOND OUELLE, would be explicable,—this of course assuming that the root KAM, or equivalent, occurs in the dialects of Indians, Abnakis or others, residing on the upper parts of the Saint Lawrence, and accustomed to think *down* rather than *up* the river. The root does occur, indeed, in the dialect of the Abnakis, who live near Quebec, in the form AGÔMI, meaning ACROSS, BEYOND, according to Prince (*American Anthropologist*, XI, 1909, 638).

Now this theory that KAM is our root meaning BEYOND receives a considerable support from Rouillard's brief discussion of the name in his *Noms Géographiques* (cited on page 262), for he quotes Père Lacombe as interpreting the word from the Cree (one of the Algonquin tongues), making it AKAM, meaning "on the other side of the water" (de l'autre bord de l'eau), clearly an equivalent of our KAM, while the remainder of the word he derives from ASKAW or RASKAW meaning "grass, rushes" (du foin, des joncs), which perhaps also is substantially correct. But this is all I can offer as to this word, which I must leave for study by those within whose personal knowledge the locality falls. It is to be noted, however, that still another interpretion has been given,—by Laurent, in his *Familiar Abenakis and English Dialogues*, Quebec, 1884, 212, who suggests an origin from Abenaki roots SKA MÔRASKUA or SKA MÔLASKUA, meaning THERE IS SOME WHITE BIRCH BARK, or THERE ARE SOME WHITE BIRCH TREES. But no evidence is given, and the explanation has obviously no more basis than an attempt to match up the parts of the word with modern roots that happen to resemble them.

There is another word ACAMAC, name of a railroad station near Saint John and known to be Indian in origin, which has the appearance of involving the root KAM; but I shall show later that the root ACAM has a very different origin and meaning.

Other Aboriginal Acadian Place-names containing the Root SOK meaning CLIFF, of CANSO.

Sevogle. Considered separately below.

KTADOOSOK. The Micmac name, according to Rand, of the Saguenay River (*First Reading Book* cited, 99, as 'KTĂDOOSŌK; *English-Micmac Dictionary*, 224; and *Micmac-English Dictionary* as KETADOOSOKE, 183). He gives the meaning as FLOWING BETWEEN TWO HIGH STEEP CLIFFS (*op. cit.* 99), thus showing

very clearly the use of the same root SŌK meaning CLIFF, as is contained in CANSO. Compare also Rand's *Legends of the Micmacs*, 250. Father Pacifique gives, independently, the same word, in the form GTATOSAG, with a meaning partially different, viz., ENTRANCE THROUGH ROCKS ("l'entrée rocheuse," in *Une Tribu Privilégiée*, 1910, 2). The resemblance of this word to Tadoussac suggests at once that the two are identical and that the Micmac name of the Saguenay, 'KTĂDOOSŌK, is the original form of our TADOUSSAC, the word SAGUENAY being the Montagnais name of the same river. The word appears first with certainty in Champlain's *Des Sauvages* of 1603 as TADOUSAC, while Lescarbot in 1609 has TADOUSSAC, both applying the name to the Port at the mouth of the Saguenay. Other interpretations of the word have, however, been given, as noted by L'Abbé Laverdière in his *Oeuvres de Champlain*, 68; and the word must have further study.

Other names which may perhaps involve this root SŌK, meaning CLIFF, are WESOKPAGEL, the aboriginal name for Newcastle Creek which empties into the head of Grand Lake in south-central New Brunswick, and which has extensive cliffs upon it; and WŌSOKSEGĔK', the Micmac name for Debert River, and for Martins Point, in Nova Scotia, according to Rand (*First Reading Book*, 87, 94). Furthermore, there is a relation between this root SŌK, and another, which appears as SOK, SAK, SAAK, and SĀĀK, with the meaning ROCK, in a number of place names (e.g., ABOOTOOSOK, NELIKSAK, ANESAK, BOOKSĀĀK, and others given in Rand's works); and these I hope later to discuss in full. It is to be noted, however, that some of these words, especially those ending in SAAK, may involve a quite different root meaning OUTLET, later to be considered.

Sevogle.

LOCATION AND APPLICATION.—The name of a river of northeast central New Brunswick, flowing eastward into the Northwest Miramichi; also extended to a post-office near its mouth; also applied to a smaller river next to the southward, in the form Little Sevogle. The name is pronounced locally SĔ-VŌ'-GUL, the E as in SET, the O as in GO and accented, and the U as in GULL. The river, which is wholly unsettled from source to mouth, is fully described and mapped, with a preliminary note on the origin of its name, in the *Bulletin of the Natural History Society of New Brunswick*, No. XXV, 1906, 537; also 533.

HISTORY OF THE NAME.—The somewhat remote position of the river is correlated naturally with a rather late appearance of the name; and the very earliest use thereof that I have been able to find is in one of the *Land Memorials* of 1805, preserved in the Government Offices at Fredericton, where it occurs in the form SOUGLE, while in another of the same series, only four years later, in 1809, it appears with its present spelling of SEVOGLE. The earliest map, of any kind, upon which I have been able to find it, is Bonnor's fine map of the Province of 1820, where it is printed SEWOGLE. Five years later, on Lockwood's map of New Brunswick, it is given as SEVOGLE, the present spelling, though there is a return to SEWOGLE on Baillie's map of New Brunswick, of 1832. All later maps, however, doubtless following Lockwood, have SEVOGLE, which has thus become fixed in our time as the undisputed standard. It is, by the way, a bit unfortunate, in the light of its local pronunciation, that the word had not been first written SEVOGUL, which would have expressed somewhat better both the local pronunciation and the etymological origin, as will be made clear below. This indeed is the spelling used by Rand, who

wrote it, obviously, according to the sound. But of course the complete prevalence of a standard spelling makes any attempt at change wholly undesirable.

Analysis of the Word.—The Micmac Indians, still living in considerable numbers upon the Miramichi, all recognize the word as belonging to their language, and give its pronunciation as SWŌ′-GUL, or SĔ-WŌ′-GUL, the E being so short as hardly to be distinguishable, and the W not prominent. As one of the best-informed of the Micmacs at Eelground, at the mouth of the Northwest Miramichi, once told me (in the language of my notes) the Indians "pronounce the word shorter than in English." Obviously it is this shorter pronunciation which is expressed in the earliest known use of the word, as recorded above, viz., SOUGLE. We may therefore accept the form SĔ-WŌ′-GUL, or better, for a reason given below, SĔ-WŌ′-KUL, with a very short E, as expressing best the aboriginal form of the name.

As to its meaning, however, the Indians that I have interviewed declared that they did not know it. In the absence of any direct testimony we have only one resource, and that is an examination of the physical features of the place to find whether it presents any character so striking and unusual as to form a natural distinctive name. Such a feature does, in fact, present itself for this river. As I reflect upon its characteristics since I traversed the length of both of its two branches several years ago, the one feature which stands out most prominently in my mind is the great series it displays of interglacial and postglacial gorges with vertical cliff walls. These gorges exceed in number and length those displayed by any other New Brunswick Stream, and at the junction of the North and South Branches of the River they form a natural T-shaped gorge, known to lumbermen as *The Square Forks*, and to local geologists as a unique feature in river-characters for this part of America. The details of these gorges, with a full description of the Square Forks, are given in the articles above cited in the *Bulletin of the Natural History Society of New Brunswick*. In these striking cliff-walled gorges, especially those at the Square Forks, accordingly, we have a natural, or in the light of the genius of Indian name-giving, one may say inevitable, basis for a distinctive place-name for the river. Now, with the idea of the cliffs in mind, it is not difficult to find the roots in the word SĔ-WŌ′-GUL or SWŌ′-GUL, for the resemblance of SĔ-WŌG or SWŌG to the SŌK of KAMSŌK, the original of CANSO, above considered, will at once strike the attention. The sounds of G and K are practically indistinguishable in Micmac, the actual sound, indeed, lying between the two, but as a choice between the two letters must be made, I follow Rand's usage and adopt the K. As to the difference between SE-WŌK or SWŌK, and SŌK, that, I think, is not material, especially in view of the fact, of which I have a good many examples, that Rand, whether through lack of a keenly-sensitive ear, or with a desire for the greatest simplicity of expression, did not distinguish the double vowel sound that occurs in many roots, but always ran them together. Accordingly, I am strongly inclined to think that SĔ-WŌK, or at least SWŌK, rather than the more condensed root SŌK is the real original form of the root meaning CLIFF. Of course the difference in the sounds may be dialectical, or may involve some special shade of meaning, which I have not caught, or may contain a modification applying to the Square Forks; but as to the essential identity of the two roots, in view of the similar features explained thereby, I think there is no reasonable doubt. As to the termination UL of SĔ-WŌK′-UL, that is, I think, unmistakable; it is simply the usual suffix, expressing the plural for inanimate objects, thus making the root mean not simply CLIFF but CLIFFS. Thus Rand gives for 'MTĂSOK, meaning BLUFF, the plural 'MTĂSOK-OOL (*First Reading Book*, 60). Hence it seems to be reasonably certain that the Micmac word SĔ-WŌK′-UL, applied to this river signifies CLIFFS, in allusion to the vertical rock walls of its many gorges.

And this view is in perfect agreement with that of Reverend Father Pacifique, of the Micmac mission at Restigouche, by far our most learned living authority upon the Micmac language, who wrote me some years ago that the word Sevogle means CLIFFS, as I have recorded in the *Transactions of the Royal Society of Canada*, XII, 1906, ii, 48. In that place, it is true, I expressed doubt as to the correctness of Father Pacifique's view, but further study since that time has convinced me of its correctness. Furthermore, in the same place, I expressed doubt as to the sufficiency of the cliffs as a basis for the name, outside of the Square Forks, but further study has modified that conclusion to the one here expressed.

It will be noticed that the word as given above lacks a locative termination such as Indian names almost invariably have. Yet the Indians use it with such a termination, as shown by the form SĀ-WŌ′-GĬLK (the G hard of course), given me for the word by the late Michael Flinne, the Indian teacher at Eelground. No doubt the final locative K was always present in the aboriginal form of the word, making it SĔ-WŌ-GUL-OOK′, though the Indians now frequently drop the termination under the influence of association with the whites, who use the shorter form of the word.

The name Little Sevogle, as applied to the smaller stream of that name, is evidently a white man's usage, since the Indians have a quite different name for that stream, as Rand has stated (*First Reading Book*, 91), and as I have myself confirmed from the Indians themselves. Further, my suggestion, in the *Transactions* above cited, that the name Sevogle might have belonged originally to the Little Sevogle, is evidently groundless in light of the considerations above given. The Micmacs, however, do have a "Little Sevogle," in their tongue SWOGLESIS or SWOGLECHEECH; but I have been told by them that it applies to the North Branch of the Sevogle, not to the Little Sevogle.

Other Explanations of the Name.—Of these I know but one, and that was given me by Mr. Flinne above mentioned, who said that the word meant SOUR; this was explained by a story of an early incident wherein the fish were driven away by a poisonous substance which spoiled or soured the water. Evidently Mr. Flinne's informant connected the word with the Micmac SĀOOKW, meaning SOUR (Rand, *English-Micmac Dictionary*, 245) which SĔ-WŌK′-UL somewhat resembles. But aside from this resemblance there is absolutely no ground for connecting the two words, and the interpretation cannot be considered to have any status in comparison with that founded on the positive evidence above given.

Summary. The name SEVOGLE seems without doubt a corruption of the Micmac Indian SEWŌKUL, or in full SEWŌKUL-OOK, meaning literally CLIFFS-PLACE, or more generally, THE RIVER OF MANY CLIFFS, in description of the numerous prominent gorge cliffs, culminating in the Square Forks, distinctive of this river.

Petitcodiac.

Location and Application.—The name of the most important River of southeastern New Brunswick, extended also to a Village, and a Railroad Station on its bank. It is pronounced, in educated circles, like PETTY-CODY-ACK, with all of the vowels short, and the last syllable strongly accented; but this pronunciation varies among country people and sailors to PETTY-COAT-JACK′. Thus the second T of the usual spelling PETITCODIAC is wholly silent.

History of the Name.—It makes its earliest known appearance in 1686 as PETCOUCOYEK, on the invaluable great Franquelin-de Meulles Map (*these Transactions*, III, 1897, ii, 364), a form which, in view of the easy interchangeability of K or C with T in these Indian words, might almost be read as PETCOUTOYEK.

I find it next in a document of 1702 as PÉCOUDIAK, which, in view of its later forms, I take to be a misprint for PETCOUDIAK (Rameau de Saint-Pere, *Une Colonie Féodale*, II, 335). Later, and especially in connection with the troubles which culminated in the Expulsion of the Acadians, the name finds very frequent mention in documents and upon maps, in a great variety of forms, e.g., PETKOUDIAK, PITCOUDIACK, PATCOOTYEAK, PETKOUTIEK, PATCOUTIEUK, PITCORDIAC, PITSCORDIAC, and others, with many misprinted forms, such as PELCOUDIAK, and DELKEKOUDIACK. A complete collection of the spellings would number perhaps two-score. In the French documents, however, there is a marked tendency to use the form PETCOUDIAC, or some form very close thereto, and this type survived the French period in official documents and maps, and came into use in those of the English, e.g., as PETCODIACK on a land grant of 1765, PETCUDIAC on Des Barres' *Charts* of about 1780, and in the Morse *Report* on Nova Scotia of 1784 (*Report on Canadian Archives*, 1884, xxxiii); and it is either PETCUDIAC or PETCOUDIAC upon all of the Provincial maps,—by Bonnor, Lockwood, Baillie, and others, down to Saunders' of 1842, which has PETACODIAC. Meantime, however, two other forms of spelling had originated in the early English documents. One of the two begins with the PETTCOCHACK in the very literal *Journal of Captain William Pote*, of 1745, 53, although misapplied to the Washademoak, while later English maps and documents have PETQUECHOK or some closely similar form; and this represents obviously that local pronunciation of the English sailors and rivermen, uninfluenced by any efforts to be documentarily correct, which has come down to our day in the form noted above as PETTY-COAT-JACK. The other contemporaneously-originating type of the word is more important, since it powerfully influenced our present usage. It appears exclusively in English official documents. I find it first in a document of 1738 as PETITCOUTIAK (*Nova Scotia Archives*, III, 221), though I suspect somewhat the precise accuracy of the printing. It does, however, occur as PETITCOODIAC and PETITCOODIACK in grants of land of 1765, preserved among the records at Fredericton,—while as PETICOODIAC and PETICOODIACK it reappears frequently thereafter in many records, being PETITCOUDIACK on Sproule's fine map of 1786, (*these Transactions*, VII, 1901, ii, 412). Meantime there appears (I have noticed it first in a grant of 1765 mentioned above), a tendency to change the OO into O, making the word PETICODIAC or PETITCODIAC, instead of PETITCOODIAC, and this form gradually came to prevail. Now this final form of the word presents three interesting features as compared with the French PETCOUDIAC or equivalent from which it is descended; *first*, it has acquired a syllable, after the first, very obviously under stress of easier pronunciation by English tongues; second, it has changed the OO sound into O, also through greater ease of pronunciation, the sound CODE being more familiar to the English than COOD; and third, it has acquired the anomaly of a consonant, the second T, which is absolutely silent in pronunciation. The origin of this T seems to me, however, perfectly obvious. Appearing only in English documents in the name of a place long under rule of the French and therefore associated with them, and happening to be pronounced, as to its first syllables, like the French word PETIT, that spelling was adopted either through simple associative suggestion, or else in the belief that the word really did involve the French PETIT. However this may have been at first, later the belief that the word contains PETIT became prevalent, for the form PETIT CODIACK (as two words), appears as early as 1781, in the *Journal of Henry Alline*, recurs on Wright's map of 1790, and finds definite expression in 1849 by Gesner, who, in his *New Brunswick*, 137, says that the word is derived from the French PETIT COUDE,—a

matter to be noted further below. It was this prevalent belief in a French origin involving PETIT, perhaps confirmed by Gesner's direct positive statement above cited, which led Wilkinson, greatest of New Brunswick cartographers and the first to give attention to correctness in our place-nomenclature, to adopt PETITCODIAC on his great map of 1859; and any doubts he may have had must have seemed to him settled by the presence of the PETIT in the earliest grants, as cited above, with which he was of course familiar. Wilkinson's map was the first to use this form, but his great influence fixed it as a standard which has been followed by all maps, and in all official uses since then, so that now this spelling is the universal standard. Thus it seems clear that a belief in the French origin of the word, a belief wholly groundless as we shall see in a moment, has been sufficiently influential to introduce into the word and retain there a wholly silent letter.

Analysis of the Word.—The early French forms of the word suggest an Indian origin, and in fact the Micmacs of this region claim it as their own. Thus Rand, best of authorities, gives it as derived from the Micmac PETKOOTKWEÂK' (*First Reading Book*, 96). A correspondent of mine who knew the Indians well, obtained it for me as PET-CUT-QUIACK, and Dr. W. O. Raymond tells me in a letter that John Paul, a Maliseet, gave it to him as PET-KET-QUE-AWK. I have myself obtained it from Mark Paul, Chief at Folly Point, as PET-KŌT-QUĒ-OK (in the exact form of my notes). Rev. Father Pacifique, in his most valuable *Micmac Almanac*, of 1902, 21, gives it as PETGOTGOIAG. These four forms are obviously identical, the differences representing no more than diversities in the ways by which different persons represent the same Indian sounds.

As to its meaning Rand gives it as THE RIVER BENDS ROUND IN A BOW, or BENDING AROUND (*Micmac-English Dictionary*, 188), while my correspondent was told by the Micmacs that it means VERY CROOKED, and Dr. Raymond obtained it from John Paul as A LONG TURN. With this aid it is easy to determine the roots in the word. Taking the original French as well as the Indian forms, the first root appears to be PET. Now this is very clearly identical with the BIT or BUT in Micmac words, EBĬTKWĒA' and ĔBŬTKWĒA' meaning TO BEND or TO BOW (intransitive), as given by Rand in his *English-Micmac Dictionary*, 34, 41, and obviously identical also with the root PET, PAT, or BAD in a number of Maliseet names, considered below, where it is always connected with an abrupt reverse BEND or BACK TURN in a river. In all of these words, however, the root is not simply PET, but has always associated with it a following K, so that the root in full is PETK, or EPETK. In all cases of its use in these Provinces, so far as I can find, this root applies to places in which the distinct feature is a bend or turn sweeping around to the reverse of the original direction; and indeed the first part of the root is clearly ĂP, given by Rand as an inseparable prefix meaning BACK (*op cit.* 27). We may accordingly express the root as EPETK, commonly shortened to PETK, sounded naturally in English as PET-EK, meaning BACK TURN. The second root is equally clear; it is that given by Rand as KUHTOG, or as we may express it for our purposes, KUTOG, meaning AROUND, in a number of combinations meaning to go, or turn, or flow, around (*op. cit.* 20), a significance quite clearly involved in the present name, as Rand's meaning, above given, will show. Both of the roots, PETK and KUTOG are combined in the word PETKOODASE, meaning I BEND, BOW AROUND (Rand, *Micmac-English Dictionary*, 138). The final root,—OYEK, IAC or IAK of the Early French forms, and WEÂK, UIACK, UĒ-OK, or OIAG, of the modern Micmacs, at first suggests the root meaning RUNS OUT, as found in Pokiok and other words considered in the preceding paper (page 83); but in fact it has, I am sure, a different identity, being identical with ŬYĀ or ĀYĀ, in words

meaning to BEND, or apprear around a point (Rand, *English-Micmac Dictionary*, 34 199), this significance fitting far better with the other elements in the word than the root meaning "runs out." The final K is of course simply the universal locative termination giving the word the significance of PLACE. Hence the entire word would be EPETK-KUTOG-OYE-K, meaning literally BACK TURN-AROUND-BENDS-PLACE, which meaning is in substantial agreement with that given by Rand, as noted above. This full form of the Indian word, involving some duplication of sounds, was condensed by them to a form which we may write as PET-KOOT-KOY-EK'.

If, now, we inquire as to the fitness of such a name to this River, it is not far to seek. The most striking characteristic of the Petitcodiac River, and one that differentiates it from all others in this region, is the remarkable direction of its flow. Thus, to one entering it from Chignecto Bay, an extension of the Bay of Fundy (and all of the place-nomenclature of our Acadian Indians is applied with reference to entering or ascending rivers and other watercourses), the course of the river is found to swing from southwest around to the north, northwest, west and finally southwest, thus bringing it parallel again, and in reverse to its entrance; and I have no question that it is this great reverse turn in its course that the name describes. Curiously enough, however, this great reverse bend in the main course of the Petitcodiac is not the only feature of this kind it exhibits, for, in the upper part of its course, while its main direction is continued by a smaller stream, the Anagance, the main river itself, at the present village of Petitcodiac, swings around to the northwest, north, and northeast in another but smaller bow, until it takes a northeasterly direction, in reverse of its direction below, and this new direction it keeps to its source. Indeed this bend also is sufficiently remarkable to give the name to the river. In view of this doubly striking feature, probably unique among Acadian rivers, that the river has thus two bows or bends in reverse of one another, giving the whole a flat S form, I have tried to find in the Indian roots of the name some recognition of this *double* bend, but without success, though I suspect it may be there, and demonstrable by some better philologist than I am. Possibly it is such an element which underlies the meaning VERY CROOKED, given by some Indians, as noted above.

Other Explanations of the Name.—Of these I have found but one,—that already mentioned as given by Gesner, who, in his *New Brunswick*, 137, says that the right angled turn in the River, called *The Bend* (at the present City of Moncton), was "named by the French, Petit Coude (Little Elbow), whence is derived Peticodiac, frequently called by the inhabitants Pettycoatjack." This statement, which may express Gesner's own theory as to the second part of the word (though the explanation of the first part is much older, as noted above), has been widely copied into both local and general works, and is commonly accepted as expressing the correct origin of the word. But it is absolutely erroneous as shown by four lines of evidence;—*First*, the history of the word in conjunction with its present use by the Micmacs all goes to prove an Indian, not a French, origin: *Second*, this Bend is by no means a little elbow, but a great one, the river here approaching a mile in width, making the designation wholly unsuitable: *Third*, a derivation of the second part of the word from COUDE ignores and leaves quite unexplained the presence of the termination IAC, for COUDE not CODIAC is the French for ELBOW: *Fourth*, never once in all of the many documents remaining to us from the French period, does any trace of either the PETIT or the COUDE appear, as they must necessarily have done had the word been French in origin. This name in fact is only one of several in these Provinces which are popularly explained as French, though in every case we know positively that they are Indian, and in every case, also, not a sign of a French

origin appears in the documents of the French period. The principal cases, in addition to Petitcodiac, are *Tetagouche*, said to be French Tête-à-gauche, *Tatamagouche*, said to be Tête-à-ma-gauche, *Minudie*, said to be Main-à-Dieu, *Shepody*, said to be Chapeau-Dieu, and the extinct *Aucpac*, said to be Aux Paques; and in all of these cases a plausible basis for the French origin is not wanting. Such explanations find their support in the primitive wonder instinct which rises superior, in all except the logically trained, to the critical truth-craving spirit.

Had the Micmacs not found in the distinctive reverse bend, or bends, in this River, a natural foundation for a name, they would no doubt have used a word descriptive of its other very remarkable feature, its great tidal bore. The word for the latter, however, viz., OOSOOĔGOW (Rand, *English-Micmac Dictionary*, 40), is too different to allow any theory that it is involved in the name Petitcodiac. But this root is perhaps involved in a name applied on Bellin's maps of Acadia of 1744 to a river in this vicinity, apparently the Petitcodiac (his Shepody and Memramcook Rivers being transposed), viz., PADESCOU, the latter part of which, ESCOU, might well represent a condencation of OOSOOĔGOW. It would seem not improbable that PADESCOU may represent a special name for the tidal estuary of the river, while PET-KOOT-KOY-EK was the name for the entire river, or possibly, for the upper part in description of the upper bend, though this is unlikely. But the name PADESCOU does not reappear, and this is as far as I have been able to follow that matter.

Summary. The name PETITCODIAC is of Micmac Indian origin, a corruption of PET-KOOT-KOY-EK′, which is a condensation of the roots EPET-KUTOG-OYE-K, meaning literally BACK TURN-AROUND-BENDS-PLACE, or, more generally, THE RIVER THAT BENDS AROUND BACK, in description of the remarkable way in which it swings around to a reverse direction in relation to the Bay of Fundy.

A name which bears a suggestive resemblance to Petitcodiac is PICHKOT-KOUET, applied to a River flowing into the eastern side of Grand Lake in south-central New Brunswick, as given on a copy of the great Franquelin-de Meulles map of 1686 (*these Transactions*, III, 1897, ii, 364). Since this stream leads over towards Petitcodiac, in the general direction of the ancient route of travel, I have expressed the opinion that the word might be a form of Petitcodiac, given to the stream because part of a route of travel to that river, precisely as the English gave the name Cumberland Bay to a waterway which I thought to be the same, because it led towards Fort Cumberland (*these Transactions*, II 1896, ii 229; V, 1899, ii, 248). But I now know this idea to be groundless, for further study of the region has proved that the name does not belong to Cumberland Bay at all (which indeed has a very different Indian name and has no river), but belongs to Coal Creek, a small River emptying into the head of the Lake. This is shown by a more exact study of the stream on the map of 1686, which heads, as Coal Creek does, near a stream and small Lake evidently intended for Lake Stream. More important, however, is this fact, that inspection of my photographic copy of the map of 1686 shows that the word really reads PICHKOLKOUEL (possibly PICHKOSKOUEL). Now the modern Maliseet name for Coal Creek is MESGOSGUELK (*these Transactions*, II, 1896, ii, 227), which, with omission of the locative K could equally well be written MESKOSKOUEL. Moreover M and P are interchangeable sounds in Indian words, while the French usually represented by ICH the sound which we catch as ES. There seems no doubt, accordingly, that the two words are identical.

It is possible that the name PED-COKE-GOWAC, on the coast of Maine near the Kennebec (*Collections of the Maine Historical Society*, VII, 1876, 301) involves roots identical with those in Petitcodiac, but I have not yet been able to determine this matter.

Again it is possible that MOLLYGOJACK, a name which appears to be Micmac, for a lake of curved or bent-around shape on the Terra Nova River in Newfoundland, involves the same roots in its latter part as Petitcodiac, though the resemblance to the local pronunciation of the latter (page 269) may be only accidental. This I hope later to settle.

BADKICK. The Passamaquoddy Indian name for a remarkable great bend on the Magaguadavic River, in southwestern New Brunswick, just above the present Bonny River, as shown on the detailed map made by Dugald Campbell for the Boundary Commissioners in 1797 (*Collections of New Brunswick Historical Society*, III, 1909, 177-8). On that map the name is placed on the point or tongue of the bend, in this form,—"Badkick or Pt. back again," showing that the surveyors applied the name to the Point. However, it is perfectly clear that the Indian name belonged to the bend in the river, since this brings the word into perfect harmony with others to follow, and since also the alternative form which the surveyors give, viz. "back again", can obviously apply only to the river and not to the point. In harmony with the two words to follow, and with the first root of Petitcodiac, the word evidently contains the root PETK, meaning BACK TURN, or BACK BEND, with the locative syllable IK indicating PLACE, making the word PETK-IK, meaning BACK BEND-PLACE, or PLACE WHERE THE RIVER BENDS BACK. The name does not reappear in any records, nor is it known locally; but it should be restored and should keep its historic form BADKICK.

PETKEK. The Maliseet Indian name, as I have somewhere been told though I have lost my evidence, of a place on the Tobique River, New Brunswick, presumably the bend now called the Oxbow a little below the Gulquac Branch (*these Transactions*, II 1896, ii, 276). The word of course would be identical in every respect with BADKICK just discussed, and with PATICAKE that follows. My supposition, however, in the *Transactions* above cited, that there is a connection between this word and PET-A-WE-KEK-SIS, the Maliseet name for Burnt Land Brook near by, proves incorrect, since this Indian name means BURNT LAND BROOK, as I shall show later in connection with other words involving the same roots.

PATICAKE. The name of a small Creek flowing into the Kennebecasis River a little above Hampton in southern New Brunswick. It appears first in 1785 as PATTICAKE and PADEKACE (the C being intended evidently, as hard), in the *Land Memorials* preserved at Fredericton; it is PATTICAKE on the fine Sproule map of 1786 (*these Transactions*, VII, 1901, ii, 412, but a corrected copy), PATUCAKE on a plan of 1811, and PATIKAKE, later PATICAKE (with some misprints) on the various maps of the Province down to the present. That the word is Maliseet Indian, the evidence conclusively shows. I have not myself obtained the word from them, but the late Edward Jack, one of the best of authorities, gives it as Maliseet, in these words,—"Pattacake, on Kennebecasis, should be Pat-kick-bend an oxbow in stream," (*Journal of American Folk-Lore*, VIII, 1895, 205), while Dr. W. O. Raymond has written me that John Paul, one of the best informed Indians, gave him an origin in PATY-KIK (or PAT-I-KECH) applying to the bend in the river just there. It is a fact, as the best maps show, that this brook enters the

Kennebecasis just where that river makes a remarkable great reverse bend,—a typical example of the kind called in the Province an *Oxbow*. These facts taken together make the origin of the name quite plain. The word is evidently identical with BADKICK and PETKEK, and the PETK of Petitcodiac, all considered above, i.e. it is the Indian PETK-IK, meaning BACK BEND-PLACE, in description of the oxbow in the Kennebecasis; this was familiarized into the more easily pronounced form by the whites, and extended by them to the brook.

This application of the name PETK-IK, in conjunction with the use of BADKICK and PETKEK, suggests that the word may have been a general topographical designation for Oxbows, which are common on our rivers.

The word PATICAKE, however, has undergone a further curious change in its adoption as the name of a railway station at the crossing of the brook, where it appears as PASSEKEAG. But the origin of this form has been explained (*these Transactions*, II 1896, ii, 260, 209) where PASSEKEAG is shown to be a later manufactured name made from PATICAKE on the analogy of OSSEKEAG, the old name of the next station, now called HAMPTON. Presumably it was thought that the original form PATICAKE would not form a dignified name for a railroad station.

PATAGUMKIS. The name of a small branch of the Penobscot River in Maine, a little above Matawamkeag on the west side; it is pronounced PADAGUMPUS or PADDYGUMPUS by the river men. Greenleaf, in whose list of Indian names of 1823 the word seems first to appear, says that it applies to "a point stream and falls" (*Moses Greenleaf, Maine's First Mapmaker*, 123). Greenleaf spells the word PATA-GUM-KIS, though on his map, of 1842, he has it, evidently by accidental omission, PATAGUMKI, which explains that form on Wilkinson's map of 1859. Thoreau gives it as PAYTGUMKISS, (no doubt a misprint for PATYGUMKISS) "PETTICOAT," which latter I do not understand, though it suggests Petitcodiac (*The Maine Woods*, 326). Greenleaf gives the meaning of the word, as HALF CIRCLE. Hubbard, however, (*Woods and Lakes of Maine*, 207) makes it mean SANDY ROUND COVE, though his analysis of the roots is faulty. Recently Mrs. Eckstorm, whose skilled aid I have previously had occasion to acknowledge, has sent me a note from Jas. Francis, one of the best of Maine guides and a man well versed in these matters, to the effect that Patagumkis means A SHARP TURN OF THE RIVER WHERE THE BOTTOM IS GRAVELLY, while another of her informants states that there is at low water a curved sandy beach near its mouth. Taking the data collectively, the construction of the word becomes clear. The first part obviously involves the root 'PET(E)K, (which is evidently the same in Micmac Maliseet and Penobscot), of the four names preceding, meaning a BACK TURN, with which all three explanations, HALF CIRCLE, ROUND COVE, and SHARP TURN above given are in full agreement. Greenleaf's map does in fact show an abrupt bend, presumably in reality a genuine oxbow, in the Penobscot where the Patagumkis enters. The second root is equally clear; it is plainly AMK, a very wide spread root meaning GRAVEL, or SAND, here again in full agreement with the meanings above given. The remainder of the word, i.e.—IS, appears to be nothing other than the softened locative termination—IS, used instead of IK after a preceding K sound, as mentioned for the Micmac earlier in this paper (page 264) and of which I have found a good many other examples in Penobscot, later to be presented. It cannot well represent an abbreviated diminutive, SIS, because that termination is always comparative and involves a larger PATAGUMKIK near by, of which there is no trace. The name in full, therefore, would be PETEK-AMK-IS, meaning literally BACK TURN-GRAVEL-PLACE, or, more generally,

THE GRAVELLY BEND, in description of characteristics of the locality, the word having been familiarized by the whites into the more easily pronounced form PATAGUMKIS, or, by the river men, PADAGUMPUS.

PETCONGAMOC. The Penobscot Indian name for a pond at the head of the Allagash River in Maine, according to Hubbard (*Woods and Lakes of Maine*, 209), who, however, does not show it on his map. He explains the name as meaning "crooked pond, or one that returns in the same direction in which it first ran." This explanation, given in quotation marks, and hence taken by Hubbard from an Indian, in conjuction with the form of the word, make the construction of the name quite clear. It evidently involves the root PETK meaning BACK TURN, as already considered above (page 271), united with ONGAMOC, or ONGAMOK, a common suffix meaning LAKE. Thus the word in full would be PETK-ONGAMOK meaning THE BACK TURN-LAKE, in description of its shape.

The root PETEK perhaps occurs in another Maine place-name not far from Petcongamoc, for Bouchette's large Map of Canada of 1831,—a map which incorporates the work of the earlier surveyors of the disputed boundaries,—applies PATAACTUQUAC to a stream which is apparently no other than the present Ragmuff, above Chesuncook on Penobscot, though making it empty too far down the river. This word looks very much like a form of PETEK-TUGUAC, which would be a good combination meaning BACK TURN-RIVER or OXBOW RIVER, though no reason for such a name is evident on the map. Hubbard, however, gives the Indian name for Ragmuff as PĀTĀ'WEEKTOOK, meaning BURNT LAND STREAM, which is clearly composed of two roots PĀTĀWEEK-TOOK meaning literally BURNT LAND-RIVER (*Woods and Lakes of Maine*, 208, and Map). Curiously enough Thoreau gives for this same stream, PAYTAYTEQUICK, with the same meaning as Hubbard, his form being intermediate between Bouchette's and Hubbard's (*The Maine Woods*, 325). Whether, now, Bouchette's form is really meant to be sounded with the A's long, and is simply a bad corruption of roots meaning BURNT LAND STREAM, or whether his name is what it seems, and the later Indian informants of Thoreau and Hubbard have interpreted the word wrongly, must await decision from further historical evidence in conjunction with an intimate knowledge of the place.

PATAGUSSIS. The Penobscot Indian name for the Brook now called Smith Brook, a branch of the Matawamkeag River in Maine, according to Hubbard (*Woods and Lakes of Maine*, 207). Smith Brook is a large stream entering the Matawamkeag just where the railroad makes its uppermost crossing of that River, but no map that I can find has a scale sufficiently large to show its characteristics. The name seems, however, to involve the root PETK, or PET(E)K, of the several words preceding, with the diminutive termination SIS, making it, with a final locative K,—PETK-ESISK or PETEK-ESISK, meaning LITTLE BACK TURN, or LITTLE OXBOW. Hence I venture the prediction that the characteristics of the place would show that this brook comes in at an oxbow, which is a small one in contrast with a larger not far distant on the River.

Bedeque

The name of a prominent Bay on the southwest side of Prince Edward Island; also of the Harbour formed by the easterly prolongation of the Bay; also of Settlements around the southeasterly extension of the Harbour, which merges into an estuary called Dunk River.

The name first appears, so far as I can find, as BEDEC, in 1744, apparently applied to the Bay, upon Bellin's fine *Carte de la Partie Orientale de la Nouvelle France*, although upon his larger scale *Carte de l'Acadie* of the same year, he applies the name to Dunk River. The very careful census of 1752 by the Sieur de la Roque, gives BEDEC to the Harbour (not mentioning the Bay), while he gives Rivière de BEDECQ to Dunk River (*Report on Canadian Archives*, 1905, II, Part 1, 159, 160). Pichon, in his well-known *Memoirs relating to...........Cape Breton*, 1760, 86, also uses BEDEC. The form BEDEQUE I find first upon Captain Holland's map resulting from his great survey of 1764-5 (copy in Munro's *Acts of the Privy Council, V.* 602-3), and the form was doubtless introduced by him. The name is applied on this map to the Bay, but I am told by Mr. Thomas W. May, of the Land Office at Charlottetown, that a plan of 1782 or earlier, in that office, applies the name BEDEQUE RIVER as an alternative for Dunk River. Purdy's fine *Map of Cabotia*, of 1814, applies BEDEQUE to the Village as well as the Bay. Since then, so far as I have found, all good maps use BEDEQUE for the Bay and the Village. The name is also in good local use for the Harbour, as shown by the *Sailing Directions*, though it is omitted from maps, doubtless to avoid overcrowding of names in the narrow space.

As to the origin of the name, we have no direct, though some very good circumstantial evidence. All considerations point to an Indian origin, for while BEDEQUE has a French aspect, the records above-cited show that it was earlier BEDEC, which looks Indian. I presume that the French spelling BEDEQUE was given by Holland under the impression that the word, used by the French and associated with their earlier settlement there, was in reality of French origin; and the immense influence of his remarkably fine map, made from accurate surveys, was sufficient to establish that form as the standard from his day to ours,—a phenomenon strictly paralleled in Petitcodiac and some other names already considered (page 272).

As to its original location, records also show clearly that the name applied to the Harbour and its westerly extension Dunk River, at least as early as to the Bay; and as Indian nomerclature was always specific rather than generic and given to definite spots rather than general features, there can be little doubt that the name belonged aboriginally to the Harbour and was extended to the Bay by Holland. Now this form BEDEC bears so close a resemblance to BADDECK in Cape Breton as to suggest a close relationship if not identity between the two,—a probability greatly strengthened by the occurrence of some identical spellings, as shown under Baddeck next considered. Furthermore, both words bear a striking resemblance to the root PETK, in its common form PETEK, occurring in Petitcodiac, Paticake, and other words just considered (page 271),—the root which means A TURN or BEND BACKWARDS. Acting upon this hint we ask of the maps whether any geographical feature of BEDEQUE and BADDECK involves a backward turn, as in case of the other names containing this root. The maps in fact do show such a feature. Thus, so far as Bedeque is concerned, the Bay swings around to the Harbour, and then to Dunk River, in such manner that the latter comes to lie parallel with the coast; accordingly, with respect to travel along shore from the eastward,—the direction of travel from the important Indian resorts centring in Charlottetown and from the New Brunswick coast via the crossing place at Cape Traverse,—this place did lie at the end of a great TURN BACKWARDS, which had to be made to reach it; that is, it was the place which is reached by a backward turn. And the maps show a precisely similar feature for Baddeck, as will be noted below. So marked is this feature, so consistent with the usage of the same root in other cases, and so reasonable from the point of view of Indian nomenclature, that I have little doubt that herein we have the explanation of the name. I do not take it that the root PETEK

in this name has the sense of a topographical term, as in PATICAKE and BADKICK for example, but has its broad descriptive sense, as in PETITCODIAC; that is, it does not describe any actual visible turn in the land or the water, but the fact that a reverse turn must be made in order to enter the place. An English sailor might well describe it as "Turn-back Harbour." It is quite possible that originally the word had additional syllables, or at least a terminal K or EK, the usual locative making the word a place name. Hence it was probably PETEK-OOK, or, in view of the tendency of the Micmacs to soften the K after another K sound (page 264 of the present paper), PETEKOOCH. No doubt the word belonged originally to the Harbour and its extension Dunk River, and was extended later by the whites to the Bay. An *Indian Island* in the Harbour suggests a place of Indian resort, and the centre of the application of the name.

No other explanation of the origin of Bedeque has been published, so far as I can find.

We may summarize accordingly, by saying that BEDEQUE is a corruption under influence of French suggestion, from a Micmac Indian word which was in all probability PETEK-OOK or PETEK-OOCH, meaning BACK TURN-PLACE, or more generally THE PLACE THAT LIES ON THE BACKWARD TURN, in description of the position of the Harbour in relation to Indian travel along the shore from the eastward.

An incidental point of interest in connection with the nomenclature of Bedeque Bay should here receive mention. On Holland's map of the Island of 1765, and most others since then, the Bay is called HALIFAX or Bedeque Bay, while its eastern extension is called DUNK River, and its western extension is called either SANBURY (on Holland and some that follow him) or SUNBURY Cove. These names all go back clearly to this great map of Holland's and were evidently given by him. Now I have been told by Mr. C. R. Dickie, the obliging Postmaster of Muddy Creek, near Sunbury Cove, that this name SANBURY or SUNBURY is locally considered a corruption of SOUANBERRY, from the Micmac SOUAN, meaning CRANBERRY and the English word BERRY, in description of the many cranberries on the marshes there. But I am sure this explanation is erroneous. It seems wholly improbable that so hybrid a compound of Micmac-English could have come into use as a place name, such an origin being wholly without analogy in all the place-nomenclature of these Provinces, while even if it had, a much more probable familiarization of SOUAN would be SWAN, making the word SWANBERRY, just as SOUANKIK (or SEEWANKIK) meaning CRANBERRY PLACE, on the River Saint John, has been adopted into English as SWAN CREEK (*these Transactions*, II, 1896, ii 274). Aside, however, from this point, there is good reason for the derivation of Sunbury from a very different source. It was in Captain Holland's day the custom for the government surveyors to name places for officials then prominent in England. The great *Atlantic Neptune*, the remarkable collection of charts supervised by DesBarres, abounds in such names, very few of which, however, have survived. Now a nobleman prominent in English public life (Secretary of State), at the time Holland was giving his names, was the Earl of HALIFAX, the same for whom the capital of Nova Scotia was named. Further, the family name of this Earl was George DUNK Montague, thus explaining the association of HALIFAX and DUNK at Bedeque. But further yet, he was also Viscount SUNBURY (*Educational Review*, St. John, XV, 1902, 160; and Murdoch's *Nova Scotia*, II, 150), in view of which fact we can hardly doubt that the association of Sunbury with Dunk and Halifax at Bedeque has this origin. As to the spelling SANBURY, that I take to be simply a slight error either

of Holland's understanding of the Earl's secondary title, or of some copyist's confusion of A and U, which are certainly very similar as commonly written. That this was the view of the later map-makers is shown by their use of the correct form SUNBURY.

Baddeck.

The name of a River in Cape Breton, emptying into a branch of Little Bras d'Or Lake; also a small Bay to the eastward; also a Village, known as a summer resort, between the two. My material for the local geography of Cape Breton is rather scant, and I have not found the name prior to a French map which gives La R. de LABADEC. Haliburton's *Map of Nova Scotia*, of 1829, has BEDEQUE, applied to the River, with LITTLE BEDEQUE as the name of the Bay, though in his *History of Nova Scotia*, II, 236, he uses BADDECK, and applies the name also as an alternative for Saint Patricks Channel in the form BADDECK BAY. On Arrowsmith's *Map of Lower Canada*, of 1838, it is printed BEDECK, which must have been taken from some earlier map, though I have not been able to trace it farther. In general, BEDEQUE appears to prevail on maps of date prior to the middle of the last century, after which BADDECK becomes more frequent, until now it is the universally accepted and standard form.

As to its origin, Rand has derived it from the Micmac EBĂDĔK, meaning A SULTRY PLACE (*First Reading Book*, 83), though elsewhere he makes it EBATEK, meaning THE HOT PLACE (*Micmac-English Dictionary*, 181); in still a third place, he makes it EPDEK or EPTEK, meaning THE WARM PLACE (*op. cit.* 51), evidently connecting it with EPEDEK, meaning IT IS WARMED ("said of a liquid"), while in still a fourth place (*op cit.* 179) he gives it as ABADAKWITK (ABADEK) meaning A PORTION LAID ASIDE FOR ANOTHER. No reason for the application of such names to this place is suggested by Rand, nor can I find anything whatever, to justify his principal meaning, which fits ill with the reputation of Baddeck as a charming residence for the summer. Rand's implication that the word is "said of a liquid" would suggest the existence of a warm spring, or something of that sort, but nothing of the kind is known. It looks reasonably clear, accordingly, that Rand was simply seeking the Micmac root which seemed to come nearest to the present form of the word, without any attempt to connect its meaning with any feature of the place; and thus he leaves the matter in a wholly unsatisfactory state. On the other hand, an explanation of a very different standing is implied in the striking resemblance, one may almost say in the identity, of the spellings of the name BEDECK, BEDEQUE, and BADDECK, with the BEDEC and BEDEQUE of Prince Edward Island, already considered. Naturally, now, we ask whether our Baddeck presents any geographical feature like that which gave origin to the name BEDEQUE in Prince Edward Island; and we find that it does. As all good maps show, the BADDECK River, which seems very clearly to be the aboriginal bearer of the name, can only be reached by ascending the outlet of Saint Patricks Channel, and swinging around in a reverse bend through Indian Bay, at the extremity of which the river enters in a direction parallel with the channel outside. Thus the arrangement of the other Bedeque is duplicated, though upon a somewhat smaller scale, even to the detail of the association of the name *Indian* with the place and its implied importance from the Indian point of view. Herein, accordingly, I believe we have the explanation of the name BADDECK, which would thus be equivalent exactly to BEDEQUE as discussed above. It is interesting to note that, as Rand caught the word from the Micmacs, it retained the preliminary E generally missing from the

root PETK or PETEK (page 271 preceding); and furthermore Baddeck, like Bedeque, passed through the stage of French suggestion implied in its earlier spelling, but unlike Bedeque has thrown off the mask and reverted to near the aboriginal form.

The name Baddeck for the modern Village must necessarily have been given by the whites as an extension from the River, and this is probably true also of the small Bay east of the village, now called Baddeck Bay, and formerly Little Baddeck. It is, however, possible that the latter name is merely a translation from the Indian, since this Bay, like the Baddeck River, swings around in reverse of the course of travel upwards or inwards,—in this case the entrance to Bras d'Or Lake; and the application of Little Baddeck to the Bay would have been in accord with Indian usage. But a thorough examination of the old records will settle all of these questions.

In summary we may say that BADDECK is without reasonable doubt identical with BEDEQUE of Prince Edward Island, and is a corruption of the Micmac Indian, probably PETEK-OOK or PETEK-OOCH, meaning literally BACK TURN-PLACE, or more generally, THE PLACE THAT LIES ON THE BACKWARD TURN, in description of the position of the River in relation to Indian travel from Bras d'Or Lake.

It is probable that the name EBITQUEGEECHK or EBĔTKWĒGEECHK, given me some years ago by the late Michael Flinne, as the Micmac name for the Millstream, which enters the Miramichi opposite Hospital Island, involves also this root EPET(K), meaning BACKWARD TURN; and it may even be identical fundamentally with BEDEQUE and BADDECK, retaining still their old locative ending. But I have not been able to connect the root PET(E)K with any feature of the place, for although this stream does in fact bend around in reverse of the direction of the River, the bend is upward and not downward; and Indian names are given with reference to the ascent, not the descent of Rivers. Accordingly the matter must have further study.

It is probable also that the root PET(E)K appears in PAATQUNOK, the Micmac name for the Little South Branch of Nepisiguit River in northern New Brunswick (*these Transactions*, II, 1896, ii, 256), a stream which enters near a great bend in the River. But this word also must have further study.

Pokwagamoos.

The name of several small Lakes in New Brunswick and Maine, as follows:

A. In west central New Brunswick, emptying northward by a small Brook of the same name into the middle part of Eel River, which is a branch of the Saint John below Woodstock. It is a very shallow, marshy Lake with a bottom of the softest mud, often partially above the surface in very dry weather.

It appears first, so far as I can find, upon a plan of 1827, by West, in the Crown Land Office, at Fredericton, in the form POQUAGAMUS, applied to the Brook. It is on Saunders' map of New Brunswick, of 1842 in the form POCOWAGAMIS; this was copied by other maps down to that of the Geological Survey of 1885 which adopted POCOWOGAMIS. The Geographic Board of Canada has introduced a new form, POKOWAGAMIS for this Lake.

B. The aboriginal Indian name for the little Lake now called Mud Lake, at the source of the Magaguadavic River in west-central New Brunswick. I have seen it

from the neighbouring Magundy Ridge, where it shows as a very shoal marshy lake of the typical mud type. The name appears as POGUAGOMUS and POQUAGOMUS on the maps and in the records of the original careful survey of the Magaguadavic in 1797 (*Collections of the New Brunswick Historical Society*, III, 1909, 191, 194), and is still known to the older Indians living on the Saint John.

C. The reputed aboriginal Indian name, as POCOWOGAMIS, now obsolete, for a small lake on Dennis Stream, a small branch of the Saint Croix from the north below Saint Stephen, in southwestern New Brunswick (*these Transactions*, II, 1896, 11, 230).

D. The aboriginal Indian name, now spelled POCKWOCKAMUS, of "a lake or deadwater" on the Penobscot River, above Pemadumcook Lake, in Maine; extended also to a prominent fall on the same river (Hubbard, *Woods and Lakes of Maine*, 209, and his map). The name is also applied by the guides, as I am told by one of them, Mr. Guy C. Haines, of Norcross, to the chain of small ponds which include River Pond and Compass Pond of Hubbard's map; and as these are typical shallow mud-bottomed ponds of the POKWAGAMOOS type, I have no doubt that the name belonged originally to them, and has been extended by the whites to the neighbouring deadwater and fall on the Penobscot. I find it first as POCK-WOCKAMUS (the evident original of the present form), applied to the Falls, in Jackson's *Second Annual Report on the Geology of the Public Lands*, 1838, 14, though undoubtedly it occurs much earlier. On page 53 of the same work it is PAUQUAKAMUS.

E. The aboriginal Indian name, given on Wilkinson's map as POGOWOGOMIS, but according to Hubbard (*op. cit.* 209, and his map), now replaced by *Mud Pond*, for a pond south of Chamberlain Lake, Maine, in the line of the important portage route between Penobscot and Allegash waters. The several descriptions which have been given by sportsmen and surveyors in various publications show that it possesses the same distinctive features as the other lakes of the same name. The form PONGUM GAMOOK for this lake attributed to the surveyor Odell in 1820 (the earliest use of the word I have been able to find) in the Appendix to the *Definitive Statement....of the case referred....to His Majesty the King of the Netherlands*, Washington 1829, 416-417, is obviously a misprint for POUGUM GAMOOK, since the fine *Report* of Messrs. Deane and Kavanagh on the Madawaska territory, which I have examined in the original Ms in the State House at Augusta, and which has recently been published in the *Collections of the New Brunswick Historical Society*, III, 1914, 390, has very clearly POUGUANGAMOOK (not PONGUANGAMOOK, as printed.) The N in this word is of course the usually almost silent nasal, here expressed, though generally missed. This Report calls it also MUDDY POND, showing the transition to the present name.

The substantial identity in form of these five names despite minor variations in spelling, taken in conjunction with the similarity in the characteristics of the respective places, makes it certain that they are aboriginally the same word. Although they include all that I have been able to find of the actual recorded uses of the name, I have no doubt that it was applied to innumerable small lakes of this character, precisely the kind now commonly called "Mud Lakes" by the guides and lumbermen, throughout Maliseet and Penobscot territory.

For aid in the interpretation of the word we turn naturally to the living Indians, of whom the Maliseets on the Saint John give its aboriginal form and meaning with-

out hesitation. Thus Newell Paul, one of the best of my informants, gave me (in the words of my notes), PŌK-WOG′-A-MOUS, meaning SHOAL, "as when muddy," or A SHOAL PLACE ON THE MUDDY BOTTOM. Chief Gabe Acquin, another very careful and reliable Indian, gave me POK-WOG-A-MOOSK, meaning SHALLOW LAKE; and others have confirmed these two. Seeking, accordingly, for a root for "shoal," it is perfectly easy to find. Thus in the almost identical Abenaki, Father Rasle gives PAŇG8̂ (the Ň being a nasal hardly at all sounded, and the 8̂ the sound we have to render by OO) in the combination PAŇG8̂ÉSS8, signifying "the river is low" (*Abnaki Dictionary*, 523). Trumbull, in his *Natick Dictionary*, 131, gives PONGUA as the modern Abenaki word for SHALLOW, while J. Dyneley Prince, another leading authority, gives POGUASO as the Abenaki word meaning IT IS SHALLOW (*American Anthropologist*, VII, 1910, 201). The root seems, by the way, to involve the idea of SHALLOW in the sense not so much of having little water, as of the bottom showing or breaking through, which helps to explain why it is used especially of Mud Lakes, for these are distinctly of this character. We may spell the root, for our present purpose, as POCWA, POQUA, POGUA, or POKWA, the latter, however, being preferable as harmonizing better with scientific usage.

As to the remainder of the word, that is equally clear. It involves evidently the inseparable suffix GAMOOK, meaning Lake, very common in the place-names of New Brunswick and (especially) Maine, as a list later in this series will attest. It is here expressed in the regular diminutive form, viz., GAMOO-SIS-K, condensed by the Indians to GAMOOSK (compare Gabe Acquin's form above given), meaning LITTLE LAKE, or POND, and adopted by the English without the final locative K.

This latter form, GAMOOS, by the way, offers the preferable spelling for the aboriginal form, as best expressing both its etymological origin and its Indian pronunciation, though the final syllable is naturally shortened to an US sound by the whites. Thus the best spelling for the entire word would be POKWAGAMOOS, with all the vowels short, and the accent on the second syllable. While we have thus a standard spelling for the aboriginal name, it by no means follows that we should change the existent spellings to conform thereto. On the contrary, I think it much better that in each case the spelling that offers the best mean between historical origin and local usage should be retained; and it is no disadvantage, but rather a merit that the spellings of the word would thus be different in the different cases. Although my analysis of this word is thus made through the Maliseet, sustained by Abenaki roots, it is obvious that the Penobscot name is identically the same word.

SUMMARY. The name POKWAGAMOOS is certainly of Maliseet-Penobscot origin, a condensation from the roots POKWA-GAMOO-SIS-K, meaning literally SHALLOW-LAKE-LITTLE-PLACE, or more generally, SHALLOW POND, understood as having a muddy bottom, in description of the most striking characteristic of the place.

Other aboriginal Acadian Place-names involving the root POKWA, meaning SHALLOW.

Pugwash. Considered separately below.

POKEAWIS. The apparent Passamaquoddy name, now extinct, for a large deadwater or small very narrow lake at the extreme head of the Lepreau River in southern New Brunswick. Its position is shown on a printed map in the *Bulletin of*

the Natural History Society of New Brunswick, IV, 1898, 59. On plans in the Crown Land Office at Fredericton it is also named POQUE-A-WIS and POCEAWIS, the latter form showing (its C evidently intended to be sounded hard) that the word is pronounced in four syllables. The form POQUE-A-WIS appears to ally the word to those containing POKW, meaning SHALLOW, and this seems fully confirmed by a description of the place sent me by Mr. Thomas A. Sullivan, of Bonny River, who knows it well. He says that it is not a lake proper, but "a deadwater brook one eighth of a mile wide by one mile long with narrows in the middle," and later adds that the narrows are low boggy-banked, with a rocky rip in the middle one hundred feet long. One might suppose that the existence of the narrows would involve the root POK meaning NARROW, and this may be the case, though the POKWA, meaning SHALLOW would seem to apply better, since the narrows are evidently far from the typical sort. The remainder of the word I do not understand, though possibly it is a great condensation of AGAMOOS, making the entire word equivalent to POKWAGAMOOS. Compare also the following. I am sure a study of the locality would solve it.

PUCKY. A lake on Machias waters in southeastern Maine, three miles from Pokomoonshine Lake, according to Gatschet (a letter of 1898). He adds that it is called by the Indians KEWE'SIK KU'SPEM. As KUSPEM is simply the Indian translation of our word LAKE, and its usage in this way is not aboriginal, I suspect that KEWESIK involves the root LAKE, and that PUCKY may represent its original prefix. In this case the original word may have been PUCKEWESIK, making it substantially the same as the POKEAWIS (with addition of a locative IK), previously considered, and therefore perhaps another "Mud Lake." This view receives confirmation from the fact that the *Sportsman's and Lumberman's Map of Maine* names a small lake on the Machias about three miles below Pokomoonshine Lake, and which is probably this PUCKY, *Mud Lake*.

No case of the occurrence of POKWAGAMOOS, or anything closely like it, is known to me anywhere in the territory of the Micmacs. However, as suggested by the forms POKEAWIS and PUCKY just considered, it is possible that a Micmac root equivalent to POKWA is involved in the names of certain Nova Scotian Lakes as they appear on our maps, viz., POGWA Lake emptying into the head of Saint Margarets Bay, POGUE Brook, emptying into the Stewiacke, and PUG Lakes emptying into Clyde River. But these names must have further study, from the documents and the Micmacs.

POKWASEGWEK. The Indian name of the stream now called the North East Branch of the River Magaguadavic in south-central New Brunswick; extended also on some later maps to the Lakes at the head of the Branch, now called Cranberry Lakes. The word occurs first in 1784-5 in the form POCASHAGUACK, applied to the lakes, on a Ms. map in the Crown Land Office at Fredericton, showing the winter route of Lieutenant Lambton from Fredericton to Saint Andrews. It next appears in the Journals and on the Map made by Dugald Campbell, one of the expert surveyors of the Magaguadavic River, in 1797, in the form PEGUESEGEHAWK, or PEQUESEGGEHAWK as printed in the *Collections of the New Brunswick Historical Society*, III, 1909, 186, 188. The word is nowhere explained, but I think there is no question at all as to its origin and meaning. The first part of the word suggests, through the two forms POCA and PEQUE, the root POWKA, meaning SHALLOW, already considered (page 282). Turning to Father Rasle's *Dictionary* of the allied Abenaki (523) we find the word, PAŇG8ÉSS8, meaning "the river is

low." Remembering now that the Ň of this word is a nasal hardly sounded (and not sounded by the Passamaquoddies), while the No. 8 we can only express by OO or OU, this root would read PAGOOESSOO, or, to use the spelling established under the preceding word, POKWESO. The effect of the S in this word is to give a superlative significance to the root; thus Trumbull, in his *Natick Dictionary*, 151, gives PONGUA as the modern Abenaki word for SHALLOW, but PONGUASO, as VERY SHALLOW. The termination GEHAWK, for its part, is perfectly clear, for it is obviously the root, variously spelled GEHAWK, GUEK, GUEC, etc., and which we may most simply express by GWEK, meaning STREAM, found in a good many Acadian place-names as noted already (*these Transactions*, V, 1912, ii, 189), and as will appear more fully in a later list. The surveyors spelled out all of their names on the Magaguadavic very minutely. This would make the complete word POK-WESO-GWEK, meaning literally VERY SHALLOW-STREAM, the locative K being involved in the last root. This is obviously identical with our POCASHA-GUACK-PEQUESGEHAWK, which word, with respect to its origin and history combined, we may best write POKWASEGWEK, pronounced PŎK-WĂ-SĔG-WĔK′.

Turning now to test this explanation by reference to the features of the place, I can speak with confidence from a personal knowledge of this stream, refreshed from a recent visit thereto for this express purpose. Looking up the Stream, our POK-WASEGWEK, from its junction with the Magaguadavic, the contrast between the two is very great, for while the latter, though swift, is readily navigable for a canoe even at low water, the Stream, for its part, is very shoal, with much slope over a stony bed, its shoalness, indeed, being its most prominent feature for a long distance up from its mouth. The designation SHALLOW, or VERY SHALLOW, therefore, is both appropriate and distinctive, and I have no question as to the correctness of this explanation, and that the name is really POKWASE-GWEK meaning VERY SHALLOW-STREAM.

The name was extended to the Lakes at the source of the stream in the form PEQUESEGEHAWGUM on the general map of 1797 compiled from the surveyors' plans (*these Transactions*, VII, 1901, ii, 254) and on a few maps following; but it has long since disappeared. This name was obviously formed by a replacement of the final AWK by the root AWGUM, meaning LAKE, frequently found in Place-names of this region, but generally followed by the locative suffix OOK, as will later be considered.

Curiously enough the name "Shallow River" is given as an alternative name to another stream a little farther down the Magaguadavic on the opposite side, called on the Surveyors' map LIBBEGAHAWK, and now known as Davis Brook. I cannot find the least connection between any roots in this name and the meaning SHALLOW, nor is it especially appropriate to the Stream, which is a clear little brook. Accordingly I have no question that the appearance of this word "shallow" on that stream is an error of the surveyor, who heard it from the Indians as a translation of PEQUESEGEHAWK, but placed it inadvertently on the next stream below.

It is quite probable that the name POKOMOONSHINE applied to a Lake and Mountain in Eastern Maine, and thence by transference (probably) to places in New Brunswick and the Adirondacks, involves also this root POKWA, meaning SHALLOW; but later this name will be considered in full.

Pugwash.

The present name of a Harbour, River, and Village, on the north coast of Nova Scotia, not far from Baie Verte.

This name is derived by Rand, of course our very best authority upon such matters, from the Micmac PAGWĔSK meaning A SHOAL (*First Reading Book*, 97), or SHALLOW WATER (*Micmac-English Dictionary*, 187, 127). In the last-cited place he gives a further valuable hint by making PAGWESK and PAGWEK equivalent terms, while in his *English-Micmac Dictionary*, 233, we find that PAAGWĔK is a topographical term meaning A SHOAL, "of rocks in the water." Thus it seems quite clear that the first part of the word, PAGW or PAAGW, is the exact Micmac equivalent, in root and meaning, of the Maliseet-Abenaki POKWA, meaning SHALLOW, already considered (page 282). Turning now to the characteristics of the place Pugwash, in order to ascertain whether the root is thereby explained, we have no difficulty in deciding. Thus Lockwood, in his *Brief Description of Nova Scotia*, London, 1818, 50, says that Pugwash is "a blind little harbour, with a reef or ledge at its eastern point, and at its mouth a bar of 18 feet." Speaking of this reef or ledge, the *Sailing Directions*, 89, say,—"Pugwash Reef extends ¾ mile northwestward from Pugwash Point, and dries out about half that distance. There are rocky patches, with 11 and 12 feet water, ¾ mile off the point to the northward, and others farther to the eastward, a full mile out from the shore." This shoal or reef is represented clearly upon the charts, and is thought sufficiently remarkable to be represented on the large-scale Geological map, which does not otherwise represent any feature of this kind along this coast. Furthermore, aside from this shoal, all the testimony of charts, *Sailing Directions* and descriptions agree that the Harbour is a good one, with sufficient water for vessels, and by no means to be characterized as "shallow." The word PUGWASH seems to me therefore undoubtedly founded upon the Micmac PAAGWĔK, meaning, as mentioned above, A SHOAL, referring to rocky reefs, and describing the prominent and distinctive rocky shoals at the eastern entrance to the Harbour. In the absence of any other such place along this coast, the Indians would find it entirely natural to describe this harbour as "the place where the (rocky) shoal is."

But although the general meaning of the word is thus clear, it remains to be explained why the Micmac form of the word is PAGWESK, containing an S, when the term from which it comes is simply PAAGWEK or PAGWEK. This, also, seems to me quite clear. PAGWEK is simply a topographical term, describing any rocky shoal; in order to make such a word apply to a particular place as a place-name, the Indians invariably add a locative suffix,—EK, -OOK, -K, etc. This would make the present word PAGWEKEK. In such cases, however, where the addition of the locative brings two K sounds in close succession, the Indians seem to have softened the final K by the interposition of a CH sound, making the locative CH or CHK, as already explained under CAMSOGOOCH (page 264). Thus our word in full would be PAGWEK-ECHK which the Indians themselves undoubtedly condensed to PAGWECHK, which Rand naturally caught as PAGWESK. I think there is no doubt as to the correctness of this interpretation.

Naturally I have sought the early forms of the word as an aid to its interpretation, but have not been able as yet to discover an earlier use than that on Purdy's *Map of Cabotia*, of 1814, where it appears as POGWASH. This form is not only consistent with the interpretation above given, but even supports the identity of the root PAGW with POKW of the Maliseet-Abenaki word meaning SHALLOW.

Although I have not found any other interpretation of the word, one could be imagined in the fact that at the village of Pugwash the Harbour narrows greatly to the River, suggesting a possible origin from the root POOK meaning NARROW or NARROWS, while another place called THE NARROWS lies a little higher up the River. Against this view, however, are two facts;—*first*, the lack of any special confirmation in the roots, as compared with the positive evidence in favor of the view above expressed, and *second*, the feature of the narrowing is by no means distinctive of this river, but found also, as the best maps show, in others along this coast.

The spelling PUGWASH represents a typical example of familiarization,—the tendency of all people in adopting strange words to modify less familiar sounds into others more familiar to their speech, PAG, or POG, and WESK are not very familiar sounds to the English, but PUG and WASH really are. In this case, however, the combination has been unfortunate, giving a word not only without dignity in itself but even involving, through meaning-suggestion, an element of the absurd. If it ever becomes desirable to alter somewhat the form of the word, while retaining as much as practicable of its history, it would be much better to go back to the aboriginal form PAKWESK, or even to soften this further to PAKWECHE, or PAGWECHE.

Summary. The name PUGWASH is of Micmac Indian origin, a familiarization of PAGWESK, which is a condensation of the roots PAGWEK-ECHK, meaning literally SHOAL-PLACE, or more generally, the PLACE AT THE ROCKY SHOAL, in description of the distinctive reef extending out from the northeastern side of the Harbour.

Pocologan.

Location and Application. The name of a small River in southwestern New Brunswick, emptying south into the Bay of Fundy, west of Point Lepreau; also a small Bay, or Harbour, at its mouth; also a small Island lying off the Harbour; also a contiguous school district and a neighbouring railway station. It is pronounced PŌK-Ă-LŌ′-GŬN, the first Ō long, as in POKE, the Ă very short, so that it might equally well be written as Ĕ or Ŏ, the second Ō long as in LOW, and strongly accented, and the Ŭ short, as in GUN. On the modern maps it is spelled POPE-LOGAN, a form used by city dwellers and other users of maps, but almost unknown locally. The latter form is pronounced in three syllables, POPE-LŌ′-GŬN.

History of the Name. It makes its earliest appearance in 1785 as POKEE LOGIN, applied to the Bay, in one of the *Land Memorials* preserved at Fredericton, and appears the next year, 1786, in another of those documents, as POUGHELAGEN. On Sproule's fine map of the southwestern part of the Province, of 1786, (*these Transactions*, VII, 1901, ii, 412) it appears as POCOLOGIN, applied to the Harbour, while POCOLOGIN STREAM also appears, presumably extended from the Harbour or Bay. It later appears as POKOLOGAN in a land Memorial of 1790; while a fine Report on Roads in this region, of 1802, by Dugald Campbell, published as a Government Report, has OQUILOGAN, doubtless by an accidental omission of the preliminary P. It is POCOLOGAN and POCLAGAIN on plans of 1816, POK-LOGAN on the Lockwood map of the Province of 1825, and the Baillie map of 1832, POCLOGAN on the Baillie and Kendall map of 1832, POCOLOGAN on Saunders' map of 1842, on Wilkinson of 1859, and on others of later date, this latter form being exactly expressive of local usage. The Geological Survey Map of Charlotte County, however, published in 1880, introduces a wholly new spelling, POPELOGAN (though the *Report* it is designed to illustrate has the old POCO-LOGAN), for both Harbour and River; and this form is followed by Loggie's fine

map of the Province of 1885 and by many others since then. Seeking, now, a reason for the adoption of this form on the Geological Map, we find a suggestion in the statement on the map itself, that it was compiled "from plans by the Admiralty, Crown Lands and Geological Surveys." Since the form could not have been taken from the plans of the Crown Land Office, as the records above given well show (one possible case from a *Land Memorial*, not a plan, of 1815 is perhaps an error of my notes), we turn to the Admiralty charts. There the explanation is found, since the most detailed chart of this coast, that of Quoddy Hd. to C. Lepreau, made by Admiral Owen in 1845, while giving no name to Harbour or Stream, has POPE LOGAN for the Island, with LOGAN POINT at the south entrance to the Harbour; and this is obviously the source of the POPELOGAN of the Geological Map. Now, as to the origin of the name on Owen's chart, I do not think it represented at all any local usage, but involved some theory of Owen's as to what the word ought to be, precisely as in the case of Dochet Island, already discussed in *these Transactions*, VIII, 1902, ii, 142-3. Admiral Owen was a cousin of David Owen, longtime resident of Campobello Island, and was no doubt influenced by the latter's ideas upon local matters. Now, David Owen has left a list of place-names, dominated by the idea that many of the Indian names at Passamaquoddy were in reality French, adopted by the Indians, as already explained in this series (*these Transactions*, V, 1912, ii, 193); and I have little doubt that as David Owen believed Passamaquoddy to be an Indian corruption of a French Passe-en Acadie, and Grand Manan an Indian corruption of a French form of Great Mary, so his cousin, following the same line of thought, took POCOLOGAN for a similar Indian corruption of POPE somebody, presumably LOGAN. At all events, whether or not this explanation of the origin of this form be precisely correct, there seems to be no doubt at all that Owen's form is the origin of the spelling now on our latest maps, and that it originated with him. This form POPELOGAN, accordingly, has a wholly illegitimate origin, and as it has not yet established itself locally, it should be dropped in favor of the form POCOLOGAN, which has in its favor historical priority, a century of good usage, a perfectly definite local and official (in school district and station) standing, and, as will be shown below, consistency with etymological origin. For purposes of purely scientific etymology, it would more naturally be written POKOLOGAN, but it seems best, in the case of long-used names, to give recognition to their history, and not displace historic forms by new ones, whose only merit is a better theoretical form.

Analysis of the Word.—All indications point, of course, to an Indian origin of the name. I have not myself obtained its original form from them, but Edward Jack, an interested and competent student of these matters, obtained it as PECK-E-LĀ-GAN, meaning "a place for stopping at, where one touches" (in a letter, and given, somewhat misprinted, in his article in the *Journal of American Folk-Lore*, VIII, 1895, 205). This, by the way, is the origin of the form *Pec-e-lay'-gan*, which I altered thus to avoid accents, in *these Transactions*, II 1896, ii, 263, and which has been copied since then in various publications, including the *Century Dictionary* (see page 289 later). Again, M. Chamberlain, who also knew these Indians well, gives PĔK-I-TA'-KŬN, an obvious misprint for PĔK-I-LA'-KŬN (*Maliseet Vocabulary*, 60). These two forms, taken from the Indians quite independently of one another, are in very close agreement, while they come near as well to the early forms above recorded, excepting for some rounding off of the vowels in the English speech. Hence we may accept the aboriginal form as something very close to PEK-E-LA'-GUN, with all the vowels short. Further than this, however, I have not been able to follow the word with any certainty. I cannot find therein any roots that surely match the meaning given by Jack. Furthermore, I cannot find the name, even

after the most thorough search, elsewhere in the eastern Canadian Provinces, excepting in Popelogan Brook, on Upsalquitch; but this word the Micmacs repudiate, having a quite distinct name of their own for the Brook, and it is probably a lumberman's importation (page 291 later, also *these Transactions*, II, 1896, ii. 263). Finally I cannot match up any feature of the place, which I know well and have recently revisited for this express purpose, with the roots, excepting in this feature,—viz., Pocologan Harbour is a closed basin extending not directly into the land, but along shore. To one coasting along from the eastward, the Harbour has the aspect simply of a passage behind an insland; and one must enter it to find that it is completely closed. In this respect it resembles perfectly those blind coves, commonly also the lower ends of old closed passages behind islands, which are called in Maine by the topographical term *pokelogan*; and like the typical pokelogan also, this Harbour is shallow and mud-bottomed. Now in view of the similarity of the name, amounting almost to identity, of our POCOLOGAN and the typical Maine "pokelogan," in conjunction with the striking similarity of geographical characteristics, there is little doubt, I believe, that the words are fundamentally the same. The chief difference consists in the much larger size of our harbour as compared with the typical pokelogans along rivers, but a difference in size can hardly be supposed to have great weight in comparison with the striking similarity of other characteristics. On this view, the name would have belonged originally to the Harbour or Bay, as in fact the earliest records use it, becoming later extended to the river, which, by the way, possesses no characteristics that throw any light upon the name. Fully consistent with this origin is the absence from all of the forms, including those taken by Mr. Jack and Mr. Chamberlain direct from the Indians, of any sign of a terminal locative K, which is almost invariable with Indian place names. If, however, Pokologan is simply the topographical term pokelogan, then the absence of a terminal locative K in this case is perfectly natural. I take it POKOLOGAN was not the aboriginal Indian name for this place, but their topographical name for such a closed basin as the Harbour forms, given by them to the white settlers, and adopted by the latter as a place name.

Having traced this word to a wholly probable origin in a topographical term, with no competing explanation, it is perhaps not essential to our purpose to go any farther, since such terms may be very old, and beyond present analysis. However, POKELOGAN or POKELOKEN has an air of etymological simplicity that is very alluring, and it would certainly be a satisfaction to connect its roots with others having part in the composition of our place-names. We turn accordingly to attempt an analysis of the term POKELOGAN, as used in Maine.

The word has attracted a great deal of attention. In Bartlett's *Dictionary oj Americanisms* (2nd. edition, 1859, and later editions), the word appears as POKE-LOKEN, and is defined as "A marshy tract or stagnant pool extending into the land from a stream or lake"; and in illustration are quoted two passages from Haliburton's writings involving the word in the form POKELOKENS. One of these is credited in such manner to Sam Slick as to lead one to think that it is found in the original *Clockmaker* published before 1840, whereas in fact both quotations are taken from *Nature and Human Nature*, which was not published until 1855. Bartlett, by the way, does not correctly reproduce the spelling of that work, which is POKE-LOKEINS in one case (Chapter VIII) and POKE-LOKEN in the other (Chapter XXV). Haliburton's definition of the word at the latter place is strongly suggestive of derivation from Bartlett's *Dictionary*, in the first edition of which, published in 1848, the word occurs as POKE-LOKEN, but without quotations, as I am told. Seemingly, therefore, Haliburton got the word from the first

edition of Bartlett's Dictionary, used it twice in his book, and then was quoted as an authority by Bartlett in his second edition! The earliest original use of the word that I have been able to find, however, is by Thoreau, who, in 1848, in his paper "Ktaadn," reprinted in *The Maine Woods*, 51, uses this sentence,—"Now and then we passed what McCauslin called a pokelogan, an Indian term for what the drivers might have reason to call a poke-logs-in, an inlet that leads nowhere." Later (*op. cit.* 100), he writes,—speaking of moose tracks he saw,—"They were particularly numerous where there was a small bay, or *pokelogan*, as it is called, bordered by a strip of meadow, or separated from the river by a low peninsula covered with coarse grass, wool-grass, etc." Thoreau heard the form later as SPOKELOGAN, from an Indian, who, in response to a question as to the meaning of the word, answered "no Indian in 'em" (*op. cit.* 248). Thoreau's expressions show that he was referring to those shallow, usually mud-bottomed, coves found especially at the lower ends of former islands as relics of old passages now closed at the upper ends. Nowadays such a place is called by the lumbermen and guides, a LOGAN, an obvious abbreviation of POKELOGAN. The difficulty with the logs is not simply a pleasantry of Thoreau's, but a real one to the river-drivers, who sometimes find parts of their drives eddied into the pokelogans and caught there, though at other times these places are said to be used deliberately for storing the logs over a season. This prominence of the logans in Maine river life has led to the elevation of the word into a verb, and one is said to be "loganned," when he enters such a place and has to return, as is made very clear by Mrs. Eckstorm (Miss Hardy) in one of her articles in *Forest and Stream*, XXXVI, 1891-2, and also by her father, Manly Hardy, in the same journal LXXIV, 1910, 731. Mrs. Eckstorm tells me also that lumbermen speak of "loganning" logs, when they store them in logans. The word, by the way, both as Pokelogan and Logan is found also in the forests of the Northwest, to which presumably they have been carried by Maine lumbermen (*Terms used in Forestry and Logging*, Washington, 1905.

In later editions of his *Dictionary*, Bartlett adds other illustrations of the use of the word and this statement: "the word is the equivalent of Chippewa pokenogun, and related to pokegoma and—gomig, a recess or one-sided lake connected with the principal lake or with a river by a short outlet" citing in support Owen, *Geological Survey of Wisconsin*, 280. This latter work, by the way, merely explains the use of Pokegoma, and says nothing of Pokenogun, which I cannot find in Baraga's *Dictionary* or elsewhere. In DeVere's *Americamisms*, of 1872, the word is said to be defined as "a marsh," but this would be wrong. Murray's *Dictionary* follows Bartlett. In 1896 the identity of the New Brunswick Place-name POCOLOGAN-POPELOGAN, in the form PEC-E-LAY'-GAN, with the Maine word, was implied in a note of mine in *these Transactions*, II, 1896, ii, 263, a suggestion which was adopted by Chamberlain in 1902 (*Journal of American Folk-lore*, XV, 1902, 254), and is the origin, I think, of the statement in Clapin's *Dictionary of Americanisms* that the Maine pokelogan is also spelled popelogan. In 1903 (*Journal*, cited, XVI, 1903, 128), I pointed out the identity in use of the Maine word LOGAN and the New Brunswick word BOGAN, with the word POKELOGAN, and emphasized the probability that the two latter are corruptions, through abbreviation, from the former; and these suggestions have been incorporated into the definitions of LOGAN and POKELOKEN in the supplementary pages of the *Century Dictionary*, and in the *Handbook of American Indians*. If, by the way, illustrations of the use of the New Brunswick term are desired, they may be found in an article by G. Stead in the *Bulletin of the Natural History Society of New Brunswick*, III, 1893, 29, and in another by M. Foster, in the *Atlantic Monthly*, LXXXVI, 1900, 239, while typical illustrations of the

use of the term LOGAN, are given by Mrs. Eckstorm (Miss Hardy) in *Forest and Stream*, XXXVI, 1901, 62, by Manly Hardy in the same journal, LXXXIV, 1910, 731, and by Samuels in *With Fly-rod and Camera*, 418. It is also worth mention in this connection that in New Brunswick the word BOGAN is perhaps contracted still further, for the expression PUGHOLE, used by guides and other woodsmen to designate a boggy or marshy spot, usually one that gives rise to a small stream, may be a contraction of BOGAN, though perhaps it is simply "Bog-hole." The word PUG-HOLE is used by a guide in a letter I receive as I write this paper, and it is explained in the *Educational Review* (St. John), XIII, 1899, 148.

The only attempt at an etymological analysis of the word that I have found, is the partial one by W. W. Tooker, in the *American Anthropologist*, I, 1899, 165, who makes the first root identical with that of the southern word POQUOSIN, in which it means "to open out," "to widen," "primarily to break," the entire word describing an open marshy place by a river. Mr. Tooker is presumably right in his interpretation of this root in Poquosin, but I think he is wholly wrong in identifying it with the POKO of Pokelogan, for there is little, if anything, in the typical pokelogan to suggest opening or widening, which idea indeed, is expressed in Abenaki and Micmac by the root BAN or PAN, as shown already in the preceding paper in this series (page 12). Moreover, the word Poquosin exists among our Indians with a meaning very different from that of Pokelogan, and very like one of the popular uses mentioned by Mr. Tooker, south of New York; for M. Chamberlain, in his *Maliseet Vocabulary*, 49, gives the Maliseet word PĔK-KWES′-SŬN as meaning A WILD MEADOW. The root that is involved in Poquosin seems to me not the Abenaki PONGUA meaning SHALLOW, but the Narragansett PAHKE or POHKI, meaning CLEAR, OPEN (compare pp. 131, 234, of Trumbull's *Natick Dictionary*). Far more probable seems to me an identity of this POKO of POKOLOGAN with POWKA of POKOWOGAMOOS, meaning SHALLOW (page 282 preceding), for the pokelogans are not only typically shallow, but have mud bottoms like those of the Pokwagamoos type of "Mud Lakes." As to the remainder of the word, OLOGAN or ELOKAN, that I take to be identical with a root or roots which appear in words signifying an enclosure or receptacle. Thus there is KELAHIGAN meaning A TRAP (Rasle, *Abnaki Dictionary*, 389), the kind of trap that an animal enters, as shown by the kind called Kilheg (a persistence), in English; and there is OULAGAN, meaning A DISH, given by Father Rasle, as 8LAŇGAN, the Ň being an almost silent nasal (*op. cit.* 508), while ALAGAT, it appears, is part of a word meaning HOLE (*op. cit.* 538). The same root is evidently contained in MEGKWAH′LAGAS, a locality on the lower Penobscot, meaning "red hole (on an island)", given by Hubbard (*Woods and Lakes of Maine*, 201), and I suspect underlies the word *Allagash*, later to be considered. In the allied Micmac we have the same components obviously in ĔL-MŬNÂKŬN, meaning "a beaver's or muskrat's Hole" (Rand, *English-Micmac Dictionary*, 133). Indeed, this idea of an animal's hole or retreat, the passage into a cul-de-sac, the kind of a place our lumbermen would describe as "a hole," topographically, fits very well with both the impression made by a pokelogan and with its actual construction,—elongated, muddy, alder-bordered, difficult to traverse, uncanny; and expresses, I think, the idea underlying the use of the word pokelogan. The entire word therefore, would seem to be POKW-ELAKUN meaning literally SHALLOW-HOLE.

Reviewing the evidence as a whole, I venture the prediction that the word POKELOGAN will be found embodied in the MEGKWAHLAGAS of Hubbard, above mentioned, which I think is not correctly interpreted in its first part, and which, in view of the easy interchangeability of M and P in Indian words, could

probably be read as PEGKWAHLAGAS. In this form it differs only in its terminal letter from some of the forms above given as early recorded forms of Pocologan. Through this word I think we shall find the confirmation of our interpretation, or else, if that proves wrong, the clue to the one that is correct.

Of course the root ELAKUN is itself compound, and is resolvable perhaps, into a root EL, carrying the idea of enclosure, and AKUN, which signifies an opening or passage. Now this latter root occurs in a great many place-names as a suffix, as will later be shown, and exhibits a considerable range of pronunciation from OKUN, AKUN, AGUN, to EGUN, etc., which will explain not only some variation in the pronunciation of pokelogan, but the spelling of the latter part of some forms of the New Brunswick place-name earlier given (page 286).

While this explanation seems to me probable, it rests simply upon parallel resemblances and hence lacks proof-connection with the word in question. In this manner one can build up other explanations of the word, all reasonable, of which I have made two or three, though less probable than the one given, and hardly worth full description.

Finally, a little coincidence pointed out to me by Mrs. Eckstorm is worth notice, especially as sooner or later it is sure to be adduced in this connection. If the word were not so certainly Indian, we could readily find for it an Anglo-Saxon origin, for, according to Murray's *Dictionary*, an old word POKE means POCKET, while LOKEN means CLOSED, so that POKELOKEN could be imagined to mean a pocket-like enclosure, which a pokelogan commonly is. Of course there is nothing in this resemblance other than one of those coincidences which are so common in all philological studies.

As the foregoing discussion exhibits, the preferred spelling of the Dictionaries is POKELOKEN, which is clearly based upon the spelling used by Bartlett and adopted by Haliburton; and they have naturally been followed by others. Yet POKELOGAN is a much preferable form, both because historically prior, and also because reflecting far better the local pronunciation, as the common abbreviations LOGAN and BOGAN well show.

POPELOGAN. The name of a Brook, a branch of the Upsalquitch River, in northern New Brunswick. Although apparently Indian, the Micmacs repudiate it, and have for the brook quite a different name of their own (*these Transactions*, II, 1896, ii, 263). A Micmac chief told me, it is "a bad place to get logs out of—must be named for that", which remark not only recalls Thoreau's above noted, to a somewhat similar effect, but also suggests a possible reason for the application of the name, viz., that it was given by a lumberman from Maine because of some resemblance to a pokelogan stream there. Its form POPELOGAN long antedates that spelling on the modern maps for our Harbour and Stream in the south of the Province, for I find it on Saunders' published *Map of New Brundwick* of 1842. Saunders, in turn, undoubtedly drew the name from a Ms plan in the Crown Land Office at Fredericton, a survey of the Upsalquitch by Hunter, of 1836, for it appears thereon with the present spelling. But here is an interesting fact about the name upon Hunter's map, that while it occurs thereon as POPELOGAN, it is given also as POKE LOGAN, and the latter word is in Hunter's writing, and the former apparently in another hand. Thus we have marked support of the supposition above mentioned, that the word is a lumberman's importation from Maine, soon corrupted by the rivermen, to whom it was unfamiliar, to POPELOGAN; and still further support is given the idea of importation by the fact that the word does not appear at all on the earlier fine plan of 1820-1 by McDonald,—the original survey plan of this River.

As to its corruption, it is not without significance that I have heard it called locally PORTLOGAN, which Father Pacifique, in a letter, writes POTLOGAN.

POCUMCUS. The name of a small lake on the Scoodic, or West Branch of Saint Croix, chain in Maine. It appeared first in this form on a boundary map, from survey, in 1797 (*these Transactions*, VII, 1901, ii, 254); it is marked upon Wilkinson's map of 1859 as POKOMPKUS, though later Maine Maps have the older form. One's first thought must be that this POC, or POK, if not POKW meaning SHALLOW must be PŎK or POOK meaning NARROW; and this was the idea of the late A. S. Gatschet, who in a letter to me in 1898 made the word PUKAMKÉS'K, from PUK meaning A NARROWS or THOROUGHFARE, and AMKÉS meaning A LITTLE SANDY (or GRAVELLY) SPOT. A partially similar explanation was given by L. L. Hubbard for the obviously identical part POKUMKES of POKUMKESWAGAMOKSIS, next mentioned (*Woods and Lakes of Maine*, 209), though he makes the POKUM (which should read POGUMK) mean DRY SAND, evidently influenced by that usage in Micmac, as shown by his citation from Rand. Both Gatschet's and Hubbard's explanations, however, are purely speculative and made without any reference to any known characteristics of the places, though it happens to be a fact that Pocumcus Lake has a sand bar where it joins Grand Lake, as mentioned in the *Seventh Report....Maine Board of Agriculture* 1862, 303. On the other hand, they ignore a very remarkable and unusual geographical peculiarity which both lakes possess in common, namely, their principal inlets and their outlets lie close together, with nearly the entire lake extending off from the line between them, much as a bag hangs from its gathering strings. Furthermore, there is a little Pond, called COMPASS Pond, marked on Hubbard's map, on a small stream emptying into the west Branch of Penobscot a little above Pemadumcook Lake; and this Pond displays the same characteristic as Pokumpcus and Pokumkeswagamoksis, though in somewhat less marked degree. The resemblance in name and unusual geographical relations points to identity of name in all three cases, COMPASS being a wholly probable simplification and familiarization of POCUMCUS. Thus is suggested a derivation from the name of some object having a form or structure comparable with the geographical peculiarity here presented. Such lakes are sometimes called "Pocket Lakes" in New Brunswick (there is a good one just above Big Lake on the Little Southwest Miramichi), and I sought a word in "pocket," "bag," etc., without success, until finally in Rand's *Micmac-English Dictionary*, 142, I found the word POOGOOGUMAOO, as meaning the STOMACH or PAUNCH. I have not been able to find, as yet, the exact Maliseet or Penobscot equivalent of this word; but the relationship of Micmac to these tongues is sufficiently close to make me feel certain that a similar word exists in them. As everyone will recognize, the resemblance in form between the outlines of these lakes, and the profile of the paunch of an herbivorous animal like a Moose or a Deer, with the inlet gullet and outlet intestine not far apart and the main stomach bulging off to one side, is very close,—so close indeed as to leave in my mind little question as to the correctness of this explanation of the word. I have no doubt, accordingly, that POCUMCUS, POKUMKES, and COMPASS, all represent corruptions of the Penobscot equivalent of the Micmac POOGOOGUMAOO, meaning PAUNCH, together with the remains of some old suffix meaning POND (perhaps an extreme condensation of GAMOOKSIS, meaning LITTLE LAKE) giving to the entire word the significance of LITTLE LAKE, or POND. Thus the name would mean PAUNCH-SHAPED POND.

It is likely that the root POOG in POOGOOGUMAOO is really POOK, meaning NARROW, in allusion to the narrowing where gullet and intestine join the paunch,

and this view is strengthened by Rand's use of POOGOGWADEK as meaning A NARROW PATH (*op. cit.* 142). In this case these three words now under consideration, belong, though indirectly, with the series considered along with POKIOK in the preceding paper.

POKUMKESWAGAMOKSIS. The aboriginal name for Harrington Lake, just east of Chesuncook, in Maine, given by Hubbard (*op. cit.* 209) as PŌKŬM'-KESWANGAMŌ'KSIS. As just explained, the first part of the word is evidently identical with POCUMCUS, in description of the same feature, while the latter part is the common termination GAMOKSIS meaning POND (page 282 preceding.) The WA between the two parts represents probably a form of the common possessive A-WE, meaning ITS.

COMPASS. A little Pond emptying into the West Branch Penobscot above Lake Pemadumcook in Maine. It is no doubt a familiarization of POCUMCUS considered above, with a similar meaning of PAUNCH-SHAPED POND, in allusion to its contiguous inlet and outlet.

It is also possible that the name POKEMOUCHE, of an important locality in northeastern New Brunswick, may have a connection with POOGOOGUMAOO, through its pocket-like South River; but this matter will be later considered.

Railroad Construction and National Prosperity: An Historic Parallel.

BY ADAM SHORTT, C.M.G., F.R.S.C.

(Read May 27, 1914)

The exceptional prosperity and expansion of our Canadian Dominion during the past decade, have become matter of commonplace observation, the mainstay of postprandial orators and hard-pressed editors. Recently, however, the other side of this wave of prosperity has been attracting special attention. High prices, large profits and good wages must be paid by some one, and we have been hearing, with increasing insistence, from the people who pay, about the upward trend of the cost of living. Much of the discussion on both sides of this subject, whether in presenting explanations or advocating remedies, appears to assume that this period of prosperity, and especially the elevation attained by the cost of living, are quite new and unprecedented phenomena, specially connected in some way with our modern economic conditions.

As regards the distress and inconvenience associated with the high cost of living, many seem to consider the situation capable of effective remedy by legislative process. Laws, it is thought, might be passed for the summary suppression of the monopolists and other grasping conspirators who have contrived to levy exceptional rates upon their helpless fellow citizens. Still others who comforted themselves with theories of cause and effect which can be traced with mathematical accuracy, and with remedies which can be applied with mechanical precision, absolve all human agencies and attribute at once the joys of high profits and the sorrows of high prices to the overproduction of gold. The remedy, of course, is equally simple and universal, consisting simply in assigning by law to the standard dollar, or other gold coin, a few more grains of gold, when everything will automatically right itself.

It is not at present my purpose to dispute with these or other speculators as to causes and remedies for present conditions. I cite them simply to show how general, though varied, is the recognition of the central problem. In view, however, of the assumed uniqueness of our recent experiences and of the corresponding assumption that the remedies to be sought must be equally special and modern, perhaps even futurist in their application, it may be of some interest to

those who are curious about such matters to know that Canada has already passed through a very similar range of experiences during the decade from 1850 to 1860.

It is true that some of the most characteristic features of our modern economic and social life are found only in embryo sixty years ago, yet the parallel between the underlying features of the two periods is quite remarkable. This is especially true as regards the rapid absorption of foreign capital for the construction of extensive railroad lines, the consequent development of general prosperity, the stimulus given to the growth of towns and cities with the consequent speculation in real estate, and accompanied by a rapid rise of values in all lines of domestic produce, culminating in general complaint regarding the high cost of living. There was even the same volume and variety of explanations and remedies, none of which, however, had time to be applied before the intervention of financial stringency, followed by wide spread bankruptcy and collapse of values and the restoration of cheap living and hard times.

It is not necessary that I should recapitulate with any detail the familiar features of our recent period of prosperity. I shall, therefore, confine my attention mainly to a presentation of the corresponding facts connected with the period of prosperity during the fifties. In tracing the development of the previous period, striking parallels with present day conditions will be sufficiently obvious.

In 1849, Canada had reached one of those periods of exceptional depression, approaching despair in some quarters, which were characteristic of the 19th Century. In 1848 there had been one of those outbursts of racial bitterness and strife which had been for so long a heavy drag on the economic and political progress of Canada, in this case culminating in the burning of the Parliament Buildings at Montreal. At the same time the abolition of the Corn Laws in Britain had carried with it the removal, in 1849, of the British preference on Canadian Wheat and flour, including American wheat ground in Canada. General pessimism among the Canadian merchants and grain dealers in Eastern Canada had resulted in the famous "Annexation Manifesto." However, the abolition of the Corn Laws had soon proved immensely beneficial in Britain, and a new era of prosperity being inaugurated there, the reflex was felt in Canada, with the promise of even better markets for produce than had been enjoyed under an artificial preference at the expense of the food supplies of the British artisan. On the other hand, the new prosperity of the Mother Country developed an interest in Canadian affairs and furnished a liberal supply of capital for the financing of Canadian enterprises. The pessimistic forebodings of the commercial element in Canada

proving to be illfounded, an optimistic reaction set in, supported by good prices for Canadian produce and encouraging symptoms of commercial prosperity.

At this stage attention was directed to the fact that although the construction of canals and a general improvement of Canadian water had furnished an excellent means of transport for both Canadian and American produce during the summer months, yet traffic was practically suspended during the winter, while in the adjoining states it was maintained throughout the year by means of their railroads which had been steadily advancing for over a decade past.

Mainly through the enterprising activity of Mr. (afterwards, Sir) Francis Hincks, Canadian Minister of Finance, the first Canadian railroad policy was worked out. The object of this was to supply Canada with an adequate railway system, connected, on the one hand, with the Western American lines, and, on the other, furnishing a continuous connection with Atlantic ports open to navigation throughout the year. This first provincial policy was introduced through the medium of the Act of 1849, which contemplated assistance from the British Government for the frequently discussed project of an Intercolonial Railway, linking Canada with the Maritime Provinces, and furnishing through them communication with the Mother Country, over British territory, at all times in the year.

Previous to 1847 there was in Canada but one short railway line of fifteen miles, connecting La Prairie, opposite Montreal, with St. John on the Richelieu, and being part of the main highway between Montreal and New York. Before 1849 three other lines had been started, on the basis of purely private enterprise. But, prior to the introduction of the general government policy, there were less than fifty miles of completed railroad in the country.

The title of the Government measure of 1849 sufficiently indicates the nature of the new policy. Its object was "To provide for affording the guarantee of the province to the bonds of railway companies on certain conditions, and for rendering assistance in the construction of the Halifax and Quebec Railway." The government assistance indicated was a guarantee, at six per cent, of the bonds of railway companies, to the extent of one-half the cost of construction, for lines of seventy-five miles and upwards. Owing to difficulties and misunderstandings as between the British North American Provinces and with the Home Government, the second or interprovincial part of the Canadian policy was not realized until after Confederation. The optimism of the country with reference to the new railway projects which immediately sprang into existence to take advantage of the government assistance, was strikingly manifested in the faith of both

the government and the public in the ability of these early railroads not only to pay heavy interest on their bonds and a generous dividend on their capital stock, but to afford a substantial annual contribution towards a sinking fund to redeem their bonded indebtedness.

Owing to the very success which attended the offers of assistance on the part of the Government, it was found necessary to modify the offer of financial assistance and to confine it to a trunk line, at first from Quebec to Toronto, but ultimately extended from Rivière du Loup on the East to the St. Clair River on the West. This change was provided for in the new act of 1851, making provision for the establishment of a central trunk line. At the same time, since the Great Western Railway and the Northern Railway had already taken advantage of the Act of 1849, the promised assistance was continued in their cases.

In accordance with the new conditions of 1851, Mr. Hincks had arranged, during a visit to Britain, with the noted English railway contracting firm of Messrs. Peto, Brassey, Betts and Jackson, that their company should undertake to finance and construct the through trunk line. The province was to guarantee £3000, or $15,000, per mile on the cost of construction. On this basis the Grand Trunk Railway of Canada was chartered during the session of 1852-3. Immediately afterwards it provided for connection with a winter ocean port by leasing for 999 years the section of the Atlantic and St. Lawrence Railroad from the Canadian frontier to Portland. This was to be connected with the Trunk System from Quebec by a line from Island Pond to Richmond.

The prospectus of the Grand Trunk Railway was issued in April, 1853. From a financial standpoint it was undoubtedly a work of art. The Grand Trunk Railroad was presented as an undertaking of national importance, with the Canadian Provincial Treasury as its chief partner. A member of the Canadian Government, the Hon. John Ross, was elected President of the Company; and five other prominent members of the Government, including Mr. Hincks, were on the Canadian Board of Directors; while the heads of the two noted firms of Baring Brothers and Glyn Mills and Company, the financial agents of the Canadian Government, were prominent on the London Board of the Railway. The line was to be constructed on a basis of efficiency quite unknown in America, and on this ground American experience as to the cost of operation and maintenance was ignored. Anticipated profits were calculated on a basis of $11\frac{1}{2}$ per cent on the capital stock. As a result of this carefully planned flotation, the stocks and bonds of the new railway went off quite readily for a time. Canada was thus

assured the expenditure within its borders of hitherto undreamed of millions of capital.

In the meantime the Government had authorized municipalities, both urban and rural, to take stock or bonds in such secondary railways as might receive charters from the Government and be designed to open up important sections of the country and serve as feeders for the Trunk System of railroads. In order to aid the municipalities in borrowing capital on the British market, the Consolidated Municipal Loan Fund was established under an act of 1852. Through this many additional millions of capital were brought to the country, becoming the basis for further stock issues and borrowings on the part of a number of subsidiary railroad companies.

It is not proposed to follow up the successes or failures of these various enterprises. Here we have simply to deal with the effect upon the economic condition of the country of an unprecedented volume of capital expended in Canada mainly during the five years from 1851 to 1856. During this period the Canadian Government alone launched upon the London market upwards of $45,500,000 in loans, of which about $15,000,000 was in aid of the Grand Trunk Railway. The Municipal Loan Fund was drawn upon during this period to the extent of about $12,000,000, while several municipalities effected extensive loans on their own account. Independently of the $15,000,000 and upwards furnished by the Provincial Government, the Grand Trunk Railway had raised in shares and bonds over $48,500,000 before 1860. In addition to this, the Victoria Bridge at Montreal cost the Company about $7,000,000. In a memorial of the Company, addressed to the Provincial Government in 1861, it is claimed that the Company had spent upwards of $75,000,000 in building and equipping the Grand Trunk Railway, including the Victoria Bridge.

As already mentioned, the Government before limiting its financial aid to the main line of the Grand Trunk Railway, had already pledged its assistance to the Great Western Railway and the Northern Railway. To the former it had contributed up to 1855 about $3,750,000, and to the latter over $2,300,000. Mr. A. T. Galt, the Minister of Finance, estimated in 1860 that upwards of $100,000,000 had been expended on railroads between 1849 and 1859.

Between 1852 and 1860, the Government spent over $11,500,000 on the canals. Notwithstanding an exceptional revenue obtained by the Government, during the years of special prosperity, the debt of the Province increased from $18,782,565 in 1850, to $54,142,044 in 1859.

Space will not permit the enumeration of the many other lines of capital expenditure in Canada during the period in question. Ta-

king into consideration, however, that the population of Canada in 1851 amounted to 1,842,261, whereas in 1911 it amounted to 7,206,643; and considering the outside capital invested in the Country during the two periods under consideration, it is found that quite as much capital per head of population was introduced during the period from 1850 to 1860 as within the past ten years. This capital was expended in the earlier period within the existing provinces of Ontario and Quebec, chiefly, outside of Montreal and its district, in the former province.

What we have to consider in each case is the effect which the exceptional amounts of new capital, in proportion to the population, had upon the economic and social condition of the country in these two periods. First of all, we may briefly indicate the normal effect upon employment and prices to be expected from such a sudden and large influx of capital. This expenditure of capital, mainly in the first instance upon the railroads, naturally made great demands on labour, materials and instruments of construction. The last element would be partly supplied from abroad and partly furnished within the country. That supplied from abroad would correspondingly increase the imports, while that furnished within the country would, to some considerable extent, diminish exports and also stimulate employment for labour and other supplies and equipment. On the other hand, this expenditure and activity furnishes the chief initial stimulus for mercantile and manufacturing enterprise within the towns and cities, increasing, in like proportion, profits, salaries and wages. The increase of wages and rates of profit in turn attract the immigration of both employers and employed, but so long as the influx of capital more than keeps pace with the increase in immigration, the rates of wages and profits would continue to increase, and this was the general experience both sixty years ago and recently.

Naturally, one of the first and most obvious effects of the considerable increase in income and population is to augment the demand for the various means of life. The means of life consist partly of native products and partly of imports. The native products coming under the influence of increased cost of production, through increased wages and profits, naturally tend to rise in price more rapidly than imported goods not subject to these exceptional influences. A reference to the actual facts shows this to have occurred both in the fifties and recently. Much of the most serious increase in the cost of living was due to the rapid rise in the prices of domestic supplies, while the chief increase in the values of foreign imports resulted from the cost of distribution to the consumer after they had arrived in Canada. Domestic supplies such as bread, meat including poultry and fish, dairy produce,

eggs, fruit, vegetables, housing, fuel, recreation, municipal taxation and service, domestic and other, enormously increased in price during both periods; while foreign supplies in the shape of textiles, machinery and metallic goods and groceries such as sugar, tea, coffee, rice, etc., increased but slightly.

While, therefore, a great and sudden influx of capital brings at first a very welcome increase in wages and profits, the secondary effects on domestic supplies are not long in developing under increased demand. Thus increased income is soon met and neutralized by increased outlay. The note of joy at the opening of a new era of prosperity changes to a chorus of complaints towards its close. In these respects also there is an exact parallel between the present time and sixty years ago.

One of the most serious problems connected with such an extensive diffusion of wealth as that involved in the construction of great railroad systems, results in the stimulus given to the growth of cities and towns. In Canada in the fifties, the new railroads not only linked up for the first time and chief towns of the country, but also opened new districts in the rear of the frontier settlements, giving birth to new towns and villages, many of which indulged dreams of metropolitan futures. The effect then was just what it has been during the past decade. Real estate speculation, starting from a genuine need for civic expansion, but afterwards feeding on its own growth, resulted in ever extending subdivisions, incessant transfers of property and the visible growth of more or less mushroom fortunes. During a boom no one can be found who has lost money, but, during the subsequent reaction, real estate wrecks strew every civic shore.

In June 1854, a writer in the Toronto "Globe" dwelt at considerable length on the rapid increase in prices. "We hear little," he says, "at this moment throughout Canada save the talk of prices rising, real estate and rents going up, mechanics and laborers striking for more wages, provisions growing dearer day by day." It was during this period that Canada experienced her first labor strikes. The construction of the Grand Trunk Railway was practically suspended for a time owing to bitterly contested strikes on the part of the workmen. The Great Western and Northern Railways also suffered from the same cause.

Then as now, however, the building trades led the way in raising wages, with the natural sequence of higher rents and slum tenements. "Mechanics," continues the Globe, "employed in buildings, ask wages so much higher than it has been the custom to pay them that their employers are put to serious embarrassment and loss." This applied, of course, chiefly to those who had undertaken contracts without al-

lowing for increased wages. The argument of the laborer, however, is familiar enough to our ears. "Ask a workman in Toronto who thinks his wages ought to be \$1.75 per day instead of \$1.50 as formerly, why he makes the demand, and he will tell you that it is because provisions are dear—because the cost of maintaining his family is much greater than ever before," Beef which the year before was at $6\frac{1}{2}$ to $8\frac{1}{2}$ cents per pound, was then 10 to 14 cents; mutton which was 5 to $5\frac{1}{2}$ cents, was then $6\frac{1}{2}$ to $8\frac{1}{2}$; potatoes, formerly $36\frac{1}{2}$ to $46\frac{1}{2}$ cents per bushel, were 90 to 97 cents; hay was \$9.00 to \$12.00 a ton, and then \$18.00 to \$22.00. In fact it is claimed that prices are in many cases as high in Toronto as in New York, to which formerly much Canadian product was sent. For some time before this, owing to higher prices in the United States, Canadian cattle had been shipped out of the country, but then in the face of a greatly increased demand, due to railroad construction and other enterprises, there was great scarcity. Within another year and a half we find the tide flowing in the opposite direction, Canada importing from the United States large quantities of food products.

Already there were appearing in the papers savage attacks upon the bakers and other purveyors of food, who, being nearest the consumer, were chiefly blamed for the increase in prices. In August 1854, a baker, replying to some of these attacks, points out that although wheat had lately fallen slightly in price owing to the incoming harvest, yet the price of flour had not fallen, the baker having still to pay \$7.00 to 7.25. It is true, he admits, that certain grades of bread may be bought at $13\frac{1}{2}$ to 14 cents, but the best bread cannot be sold under 15 cents. The baker, he says, has to meet high prices of labor, high rents and dear provisions.

The Globe, in the beginning of 1855, presenting a review of the year 1854, referred, of course, to the remarkable increase in the price of wheat owing to the outbreak of the Russian War. The Canadian farmers having enjoyed a good harvest were in a very prosperous condition. The large expenditures during the year in construction of railroads and in the expansion of towns and cities had also added to the prosperity of the Province. Laborers had flocked in and found immediate employment at high rates of wages, while every article for their support and for the construction of the railroads had commanded high prices. The only backset had been in the price of timber which owing to the outbreak of the War and the over-supply in British yards had fallen in value. This had caused some failure among the Canadian dealers. The close of the year had found some stringency in the money market which might perhaps act as a check upon the growing tendency to speculation in Canada. However, there

was no immediate indication of a slacking in the rate of progress, while the cost of living still increased. The Finance Minister was even understood to be considering a proposal for increasing the salaries of the Civil Service.

Throughout 1855 railroad construction went steadily forward aided by increasing subsidies from the Provincial Government and the municipalities. The influx of British capital was increased by municipal expenditure on public utilities, the investment of large sums on corporate and private account in the building of towns, and investments in real estate. Naturally prices continued to rise throughout the year, to the joy of those who received them and the indignation of those who had to pay them.

In another editorial of the Globe on September 5th, 1855, it is observed that the prices of provisions are excessively high compared with what they were a few years ago. The housewife recalls with a sigh the time when she used to buy butter at 6½ to 10 cents with the same price for eggs. Now she pays for these necessaries 23½ to 27 cents. The writer can understand why beef, pork and mutton might be double their former prices, also why flour should be $8.00 instead of $4.00, but he finds it difficult to explain why the minor articles on local markets should have risen to such heights. Chickens, for instance, are now 60 cents a pair whereas formerly they could be had for one-third of that. Butter and eggs have even gone to four times their former rates. Eggs are actually dearer in Toronto than in New York and butter quite as high. After canvassing the matter at some length it is concluded that the high prices are due, on the one hand, to the rapid growth of the towns and cities, and on the other to the exceptional prosperity of the farmers. Owing to the unusual prices for wheat, the farmers and their families have come to despise attention to minor products for local consumption. Farmers whose land is held at from $100 to $200 per acre will not descend to truck produce, however high the price. To meet the situation a better organized and extended system for procuring market supplies of food products in particular must be introduced.

The culmination of high prices in Canada was reached during the winter of 1855-56. Another article in the Globe in 1856 refers once more to the excessive prices of all kinds of market produce and attributes it again to the indifference of the farmers spoiled by the high prices for wheat. At the same time, it is quite obvious, from the general condition of the country, that the rapidly increasing demand of the cities and the unusual diversion of labor to occupations which are not immediately productive of any supplies to meet current needs, chiefly accounted for the situation. The produce of the country

was not less but greater than formerly, yet it had not been able to keep pace with the rapidly increasing demand. As the writer in the Globe points out, during the whole of the past winter the Province has been importing from the United States, cattle, beef, pork, bacon, butter, cheese, and even certain grains, especially oats. The scarcity of labor and the high rates of wages discourage the farmers from devoting sufficient attention to these supplies, especially when wheat could be produced on a much cheaper basis. Referring to the prices of certain articles it is said that eggs during the past season were selling in Toronto at 5 cents each or 60 cents a dozen. Turkeys and fowl were beyong the ordinary purchaser, while potatoes were selling at $1.25 a bushel and other vegetables at corresponding rates. Hay was from $25.00 to $30.00 a ton.

As the summer of 1856 developed, prices were considerably lowered. At the end of July flour was $6.00 to $7.00, and oats 50 to 55 cents a bushel; hay, $10.00 to $13.00 a ton; old potatoes, $1.00 a bushel, and new ones 60 to 70 cents a peck; butter, 27 cents; eggs, 20 to 23½ cents; chickens, 40 to 60 cents a pair; beef $6.50 to $7.00 per hundred pounds, bacon and hams $10.00 to $12.00 a hundred pounds. These prices, it may be observed, being wholesale rates, are quite up to modern standards, but indicate a falling off from the previous season.

An increasing stringency in the money market towards the close of 1856 gave warning of the severe crisis to follow in 1857. The first stages of the financial check were welcomed by the more conservative element in Canada then as now, and the reasons given were much the same in both cases. The country had been running too much to mere speculation, especially in land and city lots.

The real estate boom was a very marked feature of the early period of prosperity just as it has been of the later period. In both cases it affected at once a number of the older towns and cities, and very many entirely new town plans located on some of the branch lines of the railroads. Toronto, Hamilton and London were among the older centres which were in the grip of the land boom.

Taking Hamilton as a typical example, we find that after the first burst of prosperity, due to the building of the Great Western Railroad, it had subsidized four other minor railroad lines and had undertaken very heavy municipal expenditures on its own account, notably the construction of an expensive water system. In these ways the city rolled up a debt of over $2,500,000, nearly all of which had been borrowed directly from Britain without the aid of the Municipal Loan Fund. On the strength of its glowing prospects from railroad profits and the great stimulus given to every form of local

enterprise through the expenditure of a million and a half in the city itself, the influx of rural and immigrant population and the consequent demand for houses, stores and other structures, there was developed a vigorous movement in land speculation. Not only did lots in the city itself rapidly change hands, rising in price at every transfer, but the adjoining farms were seized upon and subdivided, the lots being rapidly disposed of. As land values continued to soar, the assessment roll expanded in volume and values. This meant incresing revenue and the ability to borrow more capital in the British market. In the meantime, as the Mayor afterwards confessed, the interest on previous borrowings was punctually paid out of the proceeds of the latest loans. When, however, the crisis of 1857-8 brought the boom to an end, revealing the fact that the prospective returns from the railroads would have to be deferred at least for some time, many peolpe were thrown out of employment and left the city. With the city shorn of its outlying subdivisions, its population sinking and values falling, the civic fathers found themselves in a very difficult position. If they levied sufficient taxes to meet their engagements they would further depress values and drive more people out of the city. On the other hand, if they did not levy sufficient taxes they could not pay the interest and sinking fund charges on their bonds. The Mayor claimed that they would have to raise 50 cents on the dollar of their reduced assessment in order to meet their obligations. As between the pressure at home and the pressure abroad, the civic authorities decided that the bond holders in England might wait, and this decision was conveyed to them in a circular from the Mayor. Naturally enough, this resulted in much indignation upon the part of the English capitalists. They vigorously protested, and finally took legal action, which was met, however, by passive resistance on the part of Hamilton. These and similar proceedings on the part of Canadian municipalities, joined to the other financial collapses, had very serious effects upon Canadian credit. The financial editor of the London Times thus voiced British sentiment, "If an honourable settlement is much longer delayed it is hoped that the authorities of Canada, whether general or local, have seen the last shilling they are likely for some years to come to receive from the credulity of our investing public." Eventually the Government had to come to the rescue of a score of bankrupt municipalities, though much to the detriment of its own credit.

As a sample of the booming of many new towns on lines of railway, constructed for the development of the northern country, we may take the case of Bell Ewart, a new civic proposition on the Northern Railroad at the southwestern end of Lake Simcoe. It was started in 1854 by an enterprising gentleman from Dundas, after whom the town was

named. A long description of it, as a typical example of many new and enterprising towns, is given in the Toronto Globe of August 17th, 1854. The place was as yet but a hole in the woods with two recently completed buildings, the Bell Ewart Hotel and the railway station. Through the trees, however, might be seen the frame work of another large building which was to be a saw mill, undertaken by an American firm who proposed to convert into lumber the unbroken forest in the neighborhood. There was a wharf also, and that was all of Bell Ewart at the time. Here, however, is the programme already laid out. "A week hence there will be another tavern—one in a village, like one newspaper, never thriving—in ten days there will be a blacksmith; in a fortnight a store, where everything from a needle to an anchor will be for sale; in a month a doctor; in half a year a clergyman and a church; in a twelvemonth a newspaper. Lots are for sale now at high prices. Land near the station is worth so much per foot. Village lots, and park lots, and squares are all laid out, and we have no doubt are selling freely. The timber is growing on them yet, but what of that? The mill is there to saw it, the railroad is there to carry off the deals, and there is an open market at high prices for all that can be made. In a year what a change there will be on Bell Ewart; in five years how much greater will be the alteration." This is quite as good a prospect as any of the propositions floated in the West during the last decade. The writer adds that there are prospects of still other towns in the neighborhood, "Every few miles there will be wharves and stores from which will be brought all the produce of the neighborhood and the country behind it—Almost every point has its village plan and subdivision of lots, with arrangements for wharves." It will be observed that even in those days the term "subdivision" was in active service.

As a matter of fact, Bell Ewart quite lived up to expectations for a few years, being an active shipping centre. But it was doomed to disappear when the timber was cut and the real estate boom was exhausted. For some years afterwards the place remained on the map as a station and a post office; but even these distinctions have disappeared years ago. The high priced corner lots at so much a foot and the attractive lots for suburban residences at very reasonable rates have all lapsed into peaceful countryside. Many other attractive real estate propositions and town subdivisions were the centres of active land speculation during the same period. Many of them still exist but few realized even a fraction of the hopes that were entertained for them. Even within the last decade land values in these towns and villages have seldom reached the prices of sixty years ago.

In 1857 the railroad mileage constructed and in operation amount-

ed to 1653, with 344 miles still under construction. This meant that within eight years Canada had constructed nearly two thousand miles of railway at a cost of nearly one hundred millions. Up to this time only the Great Western Railway, between Niagara Falls and Detroit, and the Champlain and St. Lawrence Railway, a short road of 44 miles, had paid any dividends out of earnings. It was now pretty fully realized that the profits, so confidently promised in the name of the Canadain Railroads, would not be forthcoming. It was doubtful even whether a number of them would be able to meet their bonded indebtedness. As the Globe stated in July 1857, in reviewing the railroad situation, "There was a time when the faith of Canada was held in high esteem both at home and abroad; but unless good heed is taken a very different estimate will soon attach to it." This prophesy was unfortunately destined to be amply fulfilled. Already the London Times and other British papers in their financial sections were beginning to print very disparaging reports regarding the Canadian situation.

After the crises of 1857-8 there was a slight recovery in the early sixties, but the burden of debt assumed from '50 to '56, the collapse in numerous real estate booms, and the virtual bankruptcies of quite a list of municipalities, had a very depressing effect upon the country preventing any real recovery. After 1863 the long deferred liquidation began in earnest, involving the collapse of the two great banks of Western Canada, the Bank of Upper Canada and the Commercial Bank, together with several smaller institutions. The Bank of Montreal also lost heavily on its western business. As the Government had found it necessary, through its implied partnership, to come to the rescue of the Grand Trunk Railway and of the municipalities, its credit correspondingly suffered. In 1866 the Government found itself unable to raise more than half of a moderate loan, even when offering 8 per cent interest. The financial agents in Britain frankly stated to the Finance Minister that the result was due to the disastrous effect on Canadian credit of the experiences of British investors. It required nearly two generations to remove that impression from the British financial mind. This was finaly accomplished, however, about fifteen years ago. Since then Canada has once more free access to the British capital market, with the result that we have recently experienced the first real period of national prosperity, of great railroad construction, city building, real estate speculation, high wages, high profits, high prices and excessive imports since the decade with which we have been dealing. Unfortunately we are also witnessing similar calls upon the Government to come to the rescue of stranded railroads, and extravagant provincial governments, in lieu of the muni-

cipal governments of earlier days. At the same time there are peculiar differences between our modern economic structure and that of the earlier period, which may tend to preserve the country from such a disastrous collapse as that which followed the earlier era of prosperity. The discussion of this, however, lies beyond the range of this paper.

Matthew Arnold as Poet.

By PELHAM EDGAR, Ph.D.

Presented by Nathanael Burwash, F.R.S.C.

(Read May 26, 1914)

Matthew Arnold's poetry wears well, and he enjoys the exceptional privilege of being a classic who is still read. A clamorous popularity he can never have,—his tone is too quiet, his thought too discreetly tempered by an emotion that knows none of the crescendos of passion and disdains the facile appeal to our sentimental weaknesses. He is in spite of the crispness of his utterance curiously evasive, and the seeker for a positive message of encouragement must patch up a doctrine for himself elsewhere. Arnold in a well-known essay discovered the secret of Gray in the phrase,—"He never spoke out." May we not say of Arnold the poet that he never made up his mind, or only at best made up his mind that it was necessary to make up his mind? His verse presents the problem of a severed personality: his prose volumes propose the solution. And because he thought that in these latter he had discovered a valid method for confronting our doubts, he was fatuously inclined to imagine that the importance of his work lay there. We who are perhaps sceptical of his solutions cherish rather that portion of his career when the springs of verse still flowed to ease the overcharged fountains of his mind. For contagious optimism, buoyancy, passion, or for the serene content that the vision of a completer wisdom bestows we must go elsewhere—to Shelley, to Wordsworth, to Browning, to Goethe. Yet moods of the mind there are when Arnold appeals to us if not as the supreme yet as the most satisfying poet of our time, when his pensive elegiac grace, his "sense of tears in mortal things" rouses in us a quick responsive sympathy, and when his fever of unrest and the thirsting of his soul for peace are the faithful image of our own divided natures.

His earliest verses already present the problems which grew more urgent as the years advanced, and the opening poem, "Quiet Work" indicates the only solution that his poetry was capable of yielding. These are not striking verses, but there is much of Arnold in them. An eager though not slavish Wordsworthian, he seeks in nature a counterpoise for his own anxiety of soul, and for the feverish

noisy rivalries that possess the modern world. A more penetrating version of the same idea is found in the later poem "Self Dependence," and echoes of the same thought are constantly heard in his poetry:

Calm soul of all things! Make it mine
To feel, amid the city's jar,
That there abides a peace of thine,
Man did not make, and cannot mar.

The will to neither strive nor cry,
The power to feel with others give!
Calm, calm me more! nor let me die
Before I have begun to live.
Lines in Kensington Gardens.

The sonnet "To a Preacher" forbids us to think that Arnold was insensible to the surface flaws of passion that nature may seem to exhibit even to the most unwary observer. But what he points to rather is "the central peace subsisting at the heart of endless agitation," the abiding and ultimate calm of the universal life envisaged as a totality, and the unswerving security of natural law. And he is always eager to rebuke our ambitions by the contrast of our evanescent lives with the continuity of the life of the world. (*A Summer Night.*) But with the rebuke there is also at times a fortifying hint of consolation, as in the majestic close of the "Sohrab and Rustum," which far from being the artificial appendage it is sometimes unjustly held to be is rather one of the highest strokes of art to be found in modern poetry. Here our griefs are resolved, and as the verse unfolds the image of the great river flowing on under the frosty starlight to its home in the Aral Sea, the urgencies of human distress are caught up into and merged with the vast scheme of things. The desolating consciousness, too, that we are individual focal points for disaster receives its befitting admonition. The poet would not have us crushed by a sense of our littleness, but exhilarated and heartened rather by the realization that there is something other and larger than our griefs.

Arnold might not inappropriately be described as a man of romantic nerves and classic mind. The warfare in his nature is between impulse and restraint, and even to his admirers it may seem that the victory of the latter, though not ignobly gained, is still to be regretted. He is the only poet of his day who was prompted to write such low-pulsed pieces as are his "Second Best" and his "Resignation." In this last named poem he is careful to instruct

us that we must forego our passionate hopes and crave rather "for quiet and a peaceful mind." Man, the theatre of whose activities is so august—the solemn hills, the eternal streams, the lonely sky—spends himself in futile endeavour and craves a feverish joy for which these mighty witnesses give no sufficient warrant. Endurance not rapture is the secret of their strength:

> The solemn hills around us spread,
> This stream which falls incessantly,
> The strange-scrawl'd rocks, the lonely sky,
> If I might lend their life a voice,
> Seem to bear rather than rejoice.

And even could the intemperate and unjustifiable prayer of man for movement and an ampler sphere pierce the impenetrable ear of fate it would avail us nothing. Swept onward in the dazzling eddy of action our spirits have forgotten—"The something that infects the world,"—the secret namely that endurance and not rapture is the final law of all being.

Such poetry lowers the temperature of the reader, and the mood that provoked it must have acted as a blight upon the poet himself. This unprotesting stoicism infects all that Matthew Arnold has written. If the poet tells us in an unguarded moment that "with joy the stars perform their shining," we discover on analysis that this joy is little better than the mere negation of joy, the absence of striving, the freedom from all impulse to move out of the predestined circle of immutable law. Perhaps that is the true way to interpret the universal life; it is certainly not an inspiring way to interpret the eager human impulse to advance upon untrodden paths, and it is not the way adopted by those poets who conceive nature to be victoriously alive, and not magnificently alien to the impulses which govern human activities. Even Browning who makes few concessions to the modern spirit of nature worship has given us in "Paracelsus" a description of the coming on of spring to which, in its ecstasy and intimate conviction of the creative raptures that thrill the pulses of the awakening earth, Arnold's poetry never attains, though his mind hovers intermittently over the idea of a preordained harmony linking the two worlds which some disastrous chance has severed.

An enquiry into the genesis of Arnold's view brings us round to an aspect of his mind sufficiently familiar to attentive readers of his prose. He complained that Carlyle in perpetually preaching conduct to Englishmen was carrying coals to Newcastle. Arnold prefers to say, and to say it a thousand times, that with us it is now a time to

Hellenise. Greek thought and French thought are to aid us in the process, and to give us for crude fixedness and dogmatic strength the flexibility of mind requisite to our harmonious development. Similarly he finds the modern world at large infected with romantic fervours, himself likewise smitten with the universal contagion. Therefore he will preach and practise moderation, sanity, abnegation. The brow may be flushed, but the brain must be cool, the pulse may beat feverishly, but some sage physician, a Wordsworth or a wiser than he, a Goethe must lay his tempering hand upon it, and stay its throbbing ardours. And nature, whose intimate beauties he knew so well and described with such loving fidelity and with such felicity of touch as few English poets could rival and none overmatch, nature in her large cosmic aspects is for him only the wisest of physicians, with her unwearying calm counselling us to moderation, and with her continuity rebuking our ephemeral desires.

Arnold's refusal to philosophise, or shall we say rather to sophisticate nature may denote the poverty of his mind upon the mystical side, but it is richly compensated in the region of pure description where he is under no constraint to read into nature meanings which after all may be mere translations of our own labouring minds. He would not anthropomorphise God, he will not except in playful allegory anthropomorphise nature. And the gain in sanity, clearness and fidelity is noteworthy. Arnold by virtue of his limitations no less than by virtue of his qualities is among the greatest of our descriptive poets. He is never bent on making literature out of natural effects, but is satisfied if with a few delicate touches he can give us a background in harmony with the mood and tone of his poem. For Arnold's poems as a whole are rather studies of particular moods than presentations of public actions, and mood and landscape are generally so fused that the weakening of one would imply the disintegration of the other.

Though Arnold's range in poetry is somewhat severely limited at once by his fastidiousness and his incapacity, yet within these bounds there is still sufficient scope for purposes of classification. We naturally find in his volume poems that represent an effort to embody one of his favourite theories, namely, that a great action is the essential thing in poetry, and that modern poets have gone astray in their neglect of this precept, and in their eagerness to compensate the defect of action by the brilliant elaboration of individual passages. In this division of his poetry falls "Merope," which may stand for the miscarriage of his theories, and "Sohrab and Rustum" and "Balder Dead" which represent these theories successfully and even triumphantly applied. All the poems of this group labour under the

disadvantage of being obviously academic exercises. In the "Merope" his imagination was not kindled in the progress of the composition, and as a result the poem exhibits every defect of which Matthew Arnold is capable. To the lack of ecstasy we easily reconcile ourselves, for Arnold's song is rarely "rapt above the pole;" what we rather deplore is the singular deficiency of his dramatic sense, and his no less lamentable deficiency of ear in the unrhymed choruses, which may be an original attempt on his part to find a metrical equivalent for the Greek choral ode, but seem rather an unsuccessful effort to reproduce the cadences of Milton in "Samson Agonistes" or of Goethe in the "Iphigeneia." Our conclusion is that sustained poems may be written in accordance with Arnold's theory on subjects and with characters the remotest from our modern range of experience, but that only by a miracle will these poems succeed. And in so far as the effort is made to resort to the forms as well as to the themes of ancient art the prospects of success are correspondingly prejudiced. "Samson Agonistes" is at once a classically conceived tragedy and a great poem. "Merope" is a conscientious and pedantic experiment.

"Balder Dead" is even more remote in subject matter, for now we are concerned not with men but with gods. That it is not a poem which has regard to the immediate traffic of this world is no sufficient reason for slighting its merits, and these I find very considerable though critics as a rule discover little to commend in the performance. Choosing a theme from Scandinavian mythology Arnold, who at this time was bewitched by ethnological fancies, thought that he was appealing to the latent racial instincts of his Teutonic readers. Nothing of course is gained from this naive device, for it is always the story rather than its derivation that counts with the reader. Arnold's one advantage in "Balder Dead" is that he is dealing with material that is not frayed with over use as themes from Grecian mythology have now come to be. He is not so elemental and forceful as Morris in his saga of "Sigurd the Volsung," but the story as he tells it is dignified and impressive and loses nothing in the unemotional stateliness of the diction. "Sohrab and Rustum" the other Homeric experiment is too well-known to demand comment. It is the poem in which Arnold's theories can be tested to best advantage, for he has availed himself here of a story which for all its antiquity is in no sense remote from our experience, and which gave him an occasion to exhibit the fullest pathos under the most dignified restraint.

Undeniable as is the charm it exercises I cannot include the "Tristram and Iseult" among the poems which exhibit Arnold's theories of narrative verse, and for reasons sufficiently obvious. In planning his poem he made it impossible that a great action should

be represented, probably because a great action in this instance necessitated a great passion, and of depicting the latter Arnold was by his temperament palpably incapable. What we have here are only the burnt out ashes of an abandoned passion, which glows again with pitiful feebleness in the disordered memories that haunt the pillow of the dying knight. The image of the sleeping children has been often praised for its tenderness and unquestionable charm, but is not this precisely one of those carefully-wrought passages which Arnold himself felt to be intrusive in work that should exhibit an even flow of power?

The inconsequence, too, of the conclusion is not easily defended, and a letter which Sir Herbert Warren has recently made public in "The Times" informs us that Arnold's own fastidious judgment was dubious of its success. It will be remembered that the virtuous second Iseult, in the holly wood so charmingly described by the poet, beguiles her children with tales of old Brittany, with the result that the most moving love story of Arthurian romance thus fades away into futile memories of the wiles of Vivian and the tender dotage of the misguided sage, her paramour. Writing to his friend, the Rev. Herbert Hill, Arnold says: "I am still much too near my own poems (Nov. 5, 1852), to decide impartially on the justice of the particular exceptions you take to them; with regard to the conclusion of Tristram and Iseult, the story of Merlin, of which I am particularly fond, was brought in on purpose to relieve the poem, which would else, I thought, have ended too sadly; but perhaps the new element introduced is too much. I read the story of Tristram and Iseult some years ago at Thun in an article in a French review on the romance literature; I had never met with it before, and it fastened upon me; when I got back to England I looked at the 'Morte d'Arthur' and took what I could, but the poem was already in the main formed, and I could not well disturb it. [This sets the poem back to an unexpectedly early date.] If I had read the story first in the 'Morte d'Arthur' I should have managed it differently. I am by no means satisfied with Tristram in the second part myself."

We are not happy in our medievalising poets. Scott gives us something in his poems of the outward circumstances of the time; but it is in his novels that he garners the ripest results of his antiquarian studies, and even there the true inwardness of the age is perhaps to seek. Keats gives us a few revealing intuitive flashes in his "Belle Dame Sans Merci," and in the delightful unfinished "Eve of St. Mark" where we get what we are willing to accept as the shadow at least of the reality. No one now regards "Idylls of the King" as anything but a moralized and at times highly poetical modern vision

of a past that never was. Swinburne writing with energy and passion on the same theme as Arnold, so cloys his story with description that we are not sure what it is that we see behind his many-coloured words. Arnold, though a letter of his informs us that he thought he might succeed where Tennyson had failed, was doubly doomed to defeat by his modernity and by his classical sympathies. There remains William Morris to whom the thirteenth century was dearer and more native than the nineteenth, and for whom medievalising was not an aesthetic pose but a prime necessity of his mind.

In dealing with "Empedocles on Etna" we can afford to make light of the fact that Arnold once withdrew the poem from his republished works. This was an aberration of judgment, and the critical grounds on which the action was based will scarcely bear examination. He excluded the poem as will be remembered because the action was in his opinion unworthy or at best insufficient to support a sustained piece. Casually regarded the poem may lie open to this objection. The hero argues, seems at one moment to issue triumphantly from his argument, and then incontinently eclipses himself in a volcano. As drama, the poem lacks the contention of rival wills, and even within the mind of the protagonist there is little of the relief that arises from the quick interplay of conflicting emotions. Considered as narrative poetry, we readily grant that nothing of importance is narrated. But why compel ourselves to regard the poem as bound by the laws, if there are any, of narrative verse or drama? It is sufficient for us to know that here Arnold gives us under a slight veil of drama, the ripest reflections of a rich and poetic mind, and in the songs of Callicles lyrics whose purity he has never surpassed.

The great monologue especially has merits of a commanding order. Callicles on the lower reaches of the mountain has just ceased from singing of Chiron the aged centaur, and the wise lore which he in the olden time instilled into the boy Achilles. As he lays by his harp Empedocles from the heights responds, tuning his song to the note of disenchantment. The wisdom he has learnt from life is far other than that which gladdened the young dawn of the world. In this monologue Arnold seems to gather up the strains which the body of his reflective lyrics separately yields:—the aimless drift of life, and its lack of totality (St. 2, 3,); the imperative need of self-knowledge (St. 14); our too extravagant claims (St. 31 ff.); the imperturbable calm and indifference of nature (St. 36, 37); and the cleavage in our havings and our desires. Here too we find the stoic's refuge in the region of moderate bliss and low-pitched desires, and what is less usual but more welcome, the stoic's rapture revealed to us in verses whose acquiescence in fate and whose quiet joy are a quaintly

inconsistent prelude to the smoky end which awaits our philosopher.

The monologue concludes upon the characteristic Arnoldian note in which neither hedonist nor enthusiast speaks, but the man who, having faced the issues of existing ills, is content to confront life without hope as without despair:

> I say: Fear not! Life still
> Leaves human effort scope,
> But, since life teems with ill,
> Nurse no extravagant hope;
> Because thou must not dream, thou need'st not then despair!

The second act which passes on the summit of Etna introduces us to a Byronic situation—a self-tortured soul communing in solitude with the untamed elemental forces of nature. But the comparison is all in Arnold's favour. The disease of which Manfred is sick is egotism, and his remedy is to unpack his heart in wild and whirling speeches, which disclose no problem that can be considered as even remotely philosophical. The words of Empedocles have nothing of the characteristic Byronic violence; but their grief is richly freighted with ideas that lay beyond the limits of Byron's power. In the one poem we have a tragedy of the will, in the other the infinitely subtler tragedy of the intelligence.

I have said that the great monologue illustrates almost the whole range of Arnold's lyric themes. But a few types it fails to illustrate. There are notably the narrative lyrics of which "The Forsaken Merman" is the most memorable example, and a group of interesting critical poems like the "Epilogue to Lessing's Laocoon," and others like "Haworth Churchyard," and "Heine's Grave" which we find grouped among the elegiac poems, but whose predominating impulse is critical rather than elegiac. This type originated with Arnold and virtually died with him. He cultivated also the allegorical lyric which Shelley foreshadowed in the opening passage of the "Euganean Hills." To this allegorical class for example belong "A Summer Night," a poem only discreetly touched with allegory,—the brazen prison of our lives from which some few of us escape to the hazards of a tragic voyage upon a harbourless sea, and "The Buried Life" and "The Future" which are more consistently allegorical.

For the most part as we have seen the problems that press for lyric utterance in Arnold—and it is questionable whether problems ever should press for lyric utterance,—are problems of the brain and not of the heart, and the intellectual emotion they yield is designed

to stimulate only a flutter in the mind of the reader. The yearning and the ecstasy of Shelley have but a pale reflection in his work, and equally remote from his temperate manner is the warm-blooded passion of Burns. The "Switzerland" group and "Faded Leaves" proclaim the hesitating lover, and apart from these faintly anaemic poems Arnold systematically abstains from the lyric theme of love.

It is within the range of the reflective lyric that he has earned his triumphs, and it is here and in his superb elegies that he challenges comparison with the greatest of his rivals. He based his belief in the enduring efficacy of his poetry on a claim that it was more in harmony with the modern march of thought than the poetry of either Tennyson or Browning. "I shall have my turn" he confidently said. However the future may decide the issue, it still is clear that in a narrow sense he does reflect more faithfully than they some aspects of the contemporary mind, and affords to a class of readers who value ideas a satisfaction that no other poet of his century yields. Poetry at high tension he rarely gives us, but what infinite relish there is for us who love him in his cool and quiet lines!

Fine in quality though his casual lyrics are, in the elegies Arnold has undoubtedly attained his highest reach of power. He is not by nature tuneful and has not the easy naturalness which permitted Herrick for example to make musical the most casual matters of his daily experience, but in the elegy he moves among the greatest, for here at last we have all the powers of his intellectual and emotional nature working in unison, here his passion has substance and his thought has warmth. The music of the lyrics too is often thin or halting even and insecure. The rhythmic phrasing on the other hand of the "Thyrsis" and its companion piece "The Scholar Gipsy" has the richness and the sensuous glow of Keats when he is most fastidiously an artist in his odes. And nowhere else has Arnold revealed to us in such satisfying measure the resources of his poetic imagination. The "Dover Beach" and a few great lyrics besides have a high imaginative quality, but they move within narrow limits and the vistas they open are soon closed. His ordinary lyric is sharp-edged, luminous and clear. In the elegies we discover at last the misty margins of the poet's mind, and their evocative and suggestive qualities liberate as only the greatest poetry can the creative energies of the reader. And the impressions they produce on the mind are in no wise confused, because the poems are wrought under the impulse of a dominant mood which is never relaxed however artfully it may be varied from stanza to stanza. There are no prosaic lapses to break the spell to which we willingly surrender ourselves, and there is no intrusion of such alien material as perplexes us for example

in the "Adonais" where Shelley uses the mysterious Urania as a viaduct for his own super-subtle metaphysics.

It is perhaps idle to speculate on the relative merit of our greatest English elegies. We name them "Lycidas," "Adonais," "Thyrsis" and "In Memoriam" and each without question or blame attaching to our choice may have its own votaries. It is of course with the two earlier and with their ancient prototypes that the "Thyrsis" must be compared; but it is now chiefly with the differentiating qualities that I propose to deal. I suppose that critical opinion on the whole sets the "Lycidas" highest in the scale with "Adonais" and "Thyrsis" following in order of time and of merit. Personally I always like best the one that I have read last, and this is not improbably the common experience.

An obvious distinction is to be made at the outset; King and Keats were not mourned as friends by Milton or by Shelley. In neither poem is found the note of intimacy. What rather inspired the threnody was in each case some sympathy for the lot of one whom death had made frustrate of high hopes, and Shelley is moved by the added passionate impulse of one "who in another's fate now wept his own." Clough on the other hand was as close a friend as Arnold ever permitted himself to have, and given the circumstances we might have expected such intensity of personal grief as we discover in the more impassioned lyrics that Tennyson devoted to Hallam's memory. But we have on the contrary only an idealized though exquisitely phrased regret:

> Nothing is here for tears, nothing to wail,
> Or knock the breast.

The sturdy Johnson accuses Milton of elegant trifling in so far as he accommodated his lament for King to the traditional pastoral setting which classical authority has prescribed for such a theme. "Passion plucks no berries from the myrtle and ivy, nor calls upon Arethuse and Mincius, nor tells of rough satyrs and fauns with cloven heel. Where there is leisure for fiction there is little grief." The truth is rather that sorrow demands some mitigating veil if it is to furnish forth the subject matter for a sustained song. A poet may indulge the abandonment of despair and its converse the ecstasy of hope only in brief lyric snatches, or in the tense dramatic moments of tragedy. How few upon reflection are the moments of devastating sorrow in the "In Memoriam" group of lyrics, and one must search diligently in literature to find a sustained expression of grief wherein art has not contrived some alleviating device. Hugo in "Les Contemplations" has more nearly than any other achieved this miracle of directness throughout a whole group of memorial verses, yet we

note the fact that even he was compelled to the method of detached utterance. A certain reticence of grief, classical restraint call it if you will, was to be expected from a temperament so schooled in moderation as Arnold's, and the discreet pastoral setting which he chose for his "Thyrsis" appears to me the happiest solution of his difficulty. The form also was consecrated by tradition,—no light thing in Arnold's esteem, and it only remained for him to prove that he had sufficient freshness of imagination to redeem his experiment from banality. We all know how magnificently he succeeded. The obstacles themselves became his inspiration, and no other modern poet has so well demonstrated the debt which sincerity may owe to artifice.

Not like the cuckoo-bird will Thyrsis return with the returning spring:

He hearkens not! light comer, he is flown!
What matters it? Next year he will return,
And we shall have him in the sweet spring-days,
With whitening hedges, and uncrumpling fern,
And blue-bells trembling by the forest-ways,
And scent of hay new-mown.
But Thyrsis never more we swains shall see;
See him come back, and cut a smoother reed,
And blow a strain the world at last shall heed—
For Time, not Corydon, hath conquer'd thee!

And here follow, who can forget them? two stanzas in which beauty of phrase and conception are so intimately fused that each re-reading is an intensification of our original delight:

Alack, for Corydon no rival now!—
But when Sicilian shepherds lost a mate,
Some good survivor with his flute would go,
Piping a ditty sad for Bion's fate;
And cross the unpermitted ferry's flow
And relax Pluto's brow,
And make leap up with joy the beauteous head
Of Proserpine, among whose crowned hair
Are flowers first open'd on Sicilian air,
And flute his friend like Orpheus from the dead.

O easy access to the hearer's grace
When Dorian shepherds sang to Proserpine!
For she herself had trod Sicilian fields,
She knew the Dorian water's gush divine,
She knew each lily white which Enna yields,

Each rose with blushing face;
She loved the Dorian pipe, the Dorian strain,
But ah, of our poor Thames she never heard!
Her foot the Cumner cowslips never stirr'd;
And we should tease her with our plaint in vain!

A poet who can write like this is justified in sleeping with Homer under his pillow. Johnson and his present day survivors who clamour for a resolute modernity are answered if not confuted by stanzas such as these which combine in so exquisite a harmony the poetry of reminiscence and allusion with the poetic necessities of the immediate hour. The danger only is that a field so richly harvested will provide scant gleaning for succeeding generations. Nor will the newer times readily discover a poet to whom as to Arnold the ancient speech and the ancient themes are native and natural. His sincerity might prove another poet's pretence, but of Arnold himself we may say that he has sufficiently demonstrated that all themes are proper to a poet which he can make imaginatively his own.

A source of appeal in the "Thyrsis" even stronger, and stronger because more universal, than the appeal to our vagrant classical memories, derives from Arnold's imaginative and tender evocation of the less distant past. In no other poem that I know are human sympathies more subtly and lovingly inwrought into the landscape. The fields, the meadows and the hills where Thyrsis and Corydon once roamed together, when youth and the dreams of youth were theirs, though their remembrance may quicken the survivor's sorrow for the unreturning days, have still the power to chasten and subdue the heart of his grief, and all hope is not darkened in his mind while the Fyfield elm that had stood to them both for a sign and symbol still lifts its branches to the sky.

Great poetry admits no distinction between the local and the universal. Our feet may never have crushed the Cumner cowslips, nor our eyes have been gladdened by the white and purple fritillaries that spring in the Magdalen meadows, yet through the magic of these verses the sweet "city with her dreaming spires" and all the lovely landscape that hems her in become too a part of our inheritance.

ERRATUM

Quarterly issue for September, Section II., page 192, 23rd line, for Fort Smith read Fort Vancouver.

Mémoires de la Société Royale du Canada
SECTION I

Série III | MARS 1915 | Vol. VIII

La Sociologie: le mot et la chose.

Par Léon Gérin.

(Lu le 28 mai 1913)

Depuis 1912, la sociologie, comme aussi l'économie politique, figure parmi les sujets officiellement assignés aux deux sections de lettres, l'une française, l'autre anglaise, composant, avec deux sections, de sciences, la Société Royale du Canada. Cette innovation s'inspirait d'un excellent esprit. A la réunion de mai de cette année-là, grâce surtout à l'initiative de mon regretté ami Errol Bouchette, nous avions été appelés à nous prononcer sur l'opportunité d'élargir les cadres de notre société par l'établissement d'une nouvelle section vouée spécialement aux études économiques et sociales. La majorité de nos membres jugea le projet prématuré, et il fut décidé que nous nous en tiendrions à la constitution première de la Société: deux sections de lettres et deux sections de sciences.

Cependant, afin de faire bien comprendre qu'à la Société Royale on se rend parfaitement compte de l'importance grandissante acquise aux questions et aux recherches sociales, on résolut d'en inscrire formellement la mention dans la rubrique de chacune des deux sections de lettres. Et à la dernière heure on fit choix dans ce but du terme "sociologie", auquel on adjoignit plus tard celui d'" économie politique ".

Heureux de ce que les études sociales obtenaient enfin droit de cité chez nous, je n'étais pourtant pas épris (et je m'en exprimai sur-le-champ) de ce terme de " sociologie ", emprunté au vocabulaire positiviste, et qui, à cause de ses origines mêmes, me semblait devoir désigner une certaine philosophie sociale, plutôt que l'observation méthodique des faits sociaux. J'y aurais beaucoup préféré le terme plus ancien et facilement compris de " science sociale ", que mes maîtres de l'école de F. LePlay et H. de Tourville ont mis tellement en honneur. Dans les pages qui suivent, j'examine sans parti pris jusqu'à quel point j'avais raison, et je cherche à dégager l'enseignement qui découle des faits, en vue de l'avancement ultérieur des études sociales.

I

Les origines positivistes.

Le mot " sociologie " date de 1838. C'est Auguste Comte qui l'a confectionné pendant la préparation de son principal ouvrage, le *Cours de philosophie positive,* et nous allons voir en quels termes il s'en explique, il s'en excuse même. à la page 252 du t. IV (en note):

" Je crois devoir hasarder dès à présent ce terme nouveau, exactement équivalent à mon expression déjà introduite (dix-sept ans auparavant) de " physique sociale ", afin de pouvoir désigner par un nom unique cette partie complémentaire de la philosophie naturelle qui se rapporte à l'étude positive de l'ensemble des lois fondamentales propres aux phénomènes sociaux. La nécessité d'une telle dénomination pour correspondre à la destination spéciale de ce volume, fera, j'espère, excuser ici ce dernier exercice d'un droit légitime dont je crois avoir usé avec toute la circonspection convenable et sans cesser d'éprouver une profonde répugnance pour toute habitude de néologisme systématique."

En somme, au témoignage même de Comte, et comme on peut s'en assurer en compulsant ses ouvrages, c'est le terme de " science sociale " qui lui servait au début à désigner l'objet de ses études. Vers 1821, il y a substitué celui de " physique sociale ", dont son contemporain le mathématicien Quételet se sert également, et, en 1838, il hasarde le terme nouveau de " sociologie ", qui présente cet avantage d'exprimer en un seul mot exactement ce que " physique sociale " exprimait en deux. Il n'en continuera pas moins de faire un fréquent usage de " physique sociale ", comme aussi de " science sociale ". Mais, " sociologie " sera désormais l'expression favorite, la désignation officielle en quelque sorte de la doctrine positiviste en matière sociale; et la sociologie, il faut bien se pénétrer de cette idée, est la maîtresse pièce de tout le système comtiste.

Or, ce qui caractérise essentiellement le système comtiste et l'école positiviste, c'est, dans l'ordre théorique, le rejet préalable de toute idée théologique, de toute croyance au surnaturel, et même de toute notion métaphysique ou à priori, et c'est, dans l'ordre pratique, la prétention d'instituer un nouveau pouvoir spirituel, un collège de philosophes positivistes, qui doit être substitué aux institutions traditionnelles dans la direction de toute la vie individuelle et sociale. Le positiviste commence par faire table rase de tout l'acquis intellectuel et pratique de l'humanité, qu'il se fait fort de remplacer utilement par ses propres conceptions, fondées, à ce qu'il prétend, sur l'observation et la coordination méthodique des faits. Voyons un peu ce qui en est.

L'opposition irréductible entre l'état positif de l'esprit et toute conception théologique, voire même toute notion métaphysique, est un principe inséparable de la philosophie de Comte. Elle est à la base de sa fameuse théorie ou loi des trois états successifs de l'intelligence humaine: d'abord théologique, puis métaphysique, et enfin positif, ou scientifique. Et comme pour mieux faire sentir la portée de cette gradation suggestive, Comte a fini par ajouter ce corollaire à sa loi que, des divers âges de la période théocratique, c'est le plus ancien, l'âge du fétichisme qui est, en somme, le plus rapproché de la perfection de l'âge positiviste.

Comte qui juge l'état d'esprit du fétichiste supérieur à celui du polythéiste et du monothéiste, manifeste en maint endroit de ses écrits, et notamment de sa correspondance avec son ami John Stuart Mill, son hostilité envers le catholicisme. La philosophie positive, écrit-il, " arrêtera le développement de l'école catholique, en posant, dans l'ordre des idées sociales, en présence de l'esprit religieux, l'esprit scientifique, son éternel antagoniste, qui l'a déjà annulé, dans toutes les autres catégories intellectuelles ".[1]

Le 20 novembre, 1841, Comte écrit à Mill: " j'ai toujours désiré qu'une lutte directe pût enfin s'engager entre l'école franchement rétrograde, représentée par le pur catholicisme, et notre naissante école positive." Plus tard, Comte se plaint de ce que "la canaille théologique a hautement demandé au gouvernement sa démission pour avoir (dans son cours public) proclamé la nécessité de dégager aujourd'hui la morale de toute intervention religieuse." Un peu plus tard, Comte se vante d'avoir " directement proclamé pendant trois heures consécutives, devant quatre cents personnes, la supériorité morale du positivisme sur le théologisme ." Ailleurs il se plaint de ce que la religion " depuis quelques siècles, discrédite réellement tout ce qui reste exclusivement placé sous sa funeste protection." Cependant, Comte ne souffre pas qu'on le confonde avec la tourbe des athées vulgaires métaphysiciens. Aussi écrit-il " Nous n'avons vraiment de commun avec ceux qu'on appelle ainsi que de ne pas croire en Dieu." Mais il serait oiseux de multiplier davantage les citations, et je me bornerai à renvoyer au texte même de la correspondance et de la préface de M. Lévy-Bruhl.[2]

Mais ce n'est pas seulement toute théologie que le fondateur du positivisme veut bannir; il manifeste une hostilité aussi prononcée, même plus prononcée parfois, contre toute conception métaphysique, contre toute généralisation qui est autre chose que l'expression rigou-

[1] *La philosophie positive* (résumé d'Emile Rigolage), t. III, p. 61.

[2] *Lettres inédites de John Stuart Mill à Auguste Comte, avec les réponses de Comte.* Paris, Alcan, 1899; p. XX, XXII, 10, 146, 148, 160, 362, 363, 375, 403, 452, 453, 500.

reusement étroite du fait sensible. S'il rejette le mot " Providence " pour désigner la force qui mène le monde, il ne veut pas davantage du mot " Nature ", cher aux philosophes du dix-huitième siècle. Il a une égale aversion pour l'emploi du mot " cause ", et demande qu'on se borne à indiquer les conditions dans lesquelles se produit le phénomène. C'est ainsi encore qu'il ne reconnaît guère d'utilité à l'étude de la logique en elle-même, et n'admet la psychologie que sous la dépendance de la biologie, d'une part, de la sociologie de l'autre.[1]

" L'esprit théologique, écrit-il à Mill, le 23 mars 1843, est trop déchu ou trop neutralisé pour être encore vraiment dangereux dans aucune partie de notre Occident européen. C'est partout l'esprit métaphysique qui constitue désormais le seul antagoniste que le positivisme doit avoir sérieusement en vue."[2] Au reste, il comprend sous la désignation de métaphysiciens, non seulement les tenants des anciennes philosophies spiritualiste ou matérialiste, mais aussi les spécialistes scientifiques (et ils sont nombreux) qui n'acceptent pas la direction du positivisme et de son fondateur. " Quant à nos géomètres, Comte écrit-il encore à Mill le 30 décembre 1842, je voudrais presque qu'ils fussent déjà ligués avec les dévôts catholiques, protestants et déistes, pour en finir plus tôt d'eux tous ensemble."[3]

Effectivement, Auguste Comte, tout en proclamant hautement la nécessité d'appliquer à la recherche de la vérité les procédés de l'investigation scientifique, ne fit jamais lui-même qu'un usage restreint du plus fondamental de ces procédés, l'observation monographique directe. Il se borna à mettre en œuvre les résultats des recherches des divers spécialistes. En sociologie notamment, il se contenta d'observations très générales et de seconde main. Et vers la fin de sa vie, déjà dans sa *Politique positive*, et encore plus dans sa *Synthèse subjective*, il renonça de plus en plus à l'observation et à l'induction. Cette insuffisance méthodologique s'aggrave du fait de l'isolement de sa propre vie et de la pratique de cette " hygiène cérébrale ", qui lui interdit, avant même l'âge mûr, toute lecture de journaux ou de revues, comme susceptible de troubler le cours de ses méditations philosophiques.

Aussi fut-il toute sa vie moins un savant qu'un philosophe, et un philosophe très abstrait. Sa préoccupation constante était de tout ramener à l'unité, de tout systématiser. " Vous me faites peur, lui écrit un jour Stuart Mill, par l'unité et le complet de vos

[1] *Lettres Mill-Comte*, p. 6; Mill, *Auguste Comte and Positivism*, p. 56, 57, 63, 178.
[2] *Lettres*, p. 176.
[3] *Lettres*, p. 148.

convictions, qui semblent par là ne pouvoir jamais avoir besoin de confirmation de la part d'aucune autre intelligence."[1]

Bref, l'homme de science use largement de l'observation, ne généralise qu'avec prudence et s'applique en toute recherche à conserver son entière liberté d'esprit. Au contraire, le fondateur du positivisme observe peu, généralise beaucoup, et prématurément se renferme, et veut renfermer ses disciples, dans le cercle étroit de ses conclusions.

En effet, ces conclusions tirées plus ou moins arbitrairement d'observations parfois sommaires, Auguste Comte exige que ses disciples les acceptent intégralement et sans réserve. L'autoritarisme est un dernier trait de l'école positiviste qu'il ne faut pas perdre de vue. " Il n'y a pas, écrit-il, de liberté de conscience en astronomie, en physique, en chimie, en physiologie même, en ce sens que chacun trouverait absurde de ne pas croire de confiance aux principes établis dans ces sciences par les hommes compétents. S'il en est autrement en politique, c'est uniquement parce que les anciens principes étant tombés, et les nouveaux n'étant pas encore formés, il n'y a pas à proprement parler dans cet intervalle de principes établis."[2]

C'est l'étrange alliance de cet absolutisme du doctrinaire avec la curiosité et la ferveur du chercheur scientifique qui rend parfois déconcertante la lecture du *Cours de philosophie positive*, à cause des incohérences qui s'y étalent. Ce protagoniste de la " raison émancipée " ne veut pas du libre examen comme principe organique. Contempteur du catholicisme, il s'élève pourtant contre le protestantisme, qui s'est fait le propagateur de cette erreur ainsi que du " préjugé qui rejette tout pouvoir spirituel distinct et indépendant du pouvoir temporel." Enfin il se fait l'apologiste du moyen âge, le défenseur de la doctrine de l'infaillibilité pontificale, de celle du pouvoir papal, et de la pratique de la confession. Ce qui devait périr dans le catholicisme, c'est la doctrine, son organisation doit être conservée.[3]

Mill se plaint amèrement de ce que Comte ne veut pas tolérer de questions ouvertes, ne laisse aucune latitude d'opinion, et a la manie, non seulement de tout systématiser, mais encore de tout règlementer. On sait que le fondateur du positivisme a fini par transformer sa philosophie en religion, la religion de l'humanité (le Grand Etre), avec adjonction de la terre (Grand Fétiche), et

[1] *Lettres*, p. 5, 137; aussi p. XIII, XIV, XVII et XXII de la préface de M. Lévy-Bruhl;—Mill, *Comte and Posit.*, p. 108, 140, 141; Fiske, *Outlines of cosmic philosophy*, Boston, 1874, t. I, p. VIII, IX, 131 et suiv.

[2] *Philosophie positive*, t. IV, p. 50 (note).

[3] *Phil. posit.*, résumé Rigolage, t. II, p. 25, 43, 268, 270, 273, 303; t. IV, p. 11, 39, 180.

de l'espace (Grand Milieu). Les incongruités et les absurdités y sont en tel nombre que les disciples et les admirateurs les plus sincères du philosophe se sont demandé s'il ne souffrait pas alors d'une recrudescence de cette affection mentale qui déjà, en 1826, avait mis sa vie en danger.[1]

En somme, exclusion de toute théologie, de tout surnaturel, exclusion de toute métaphysique, recours exclusif aux procédés rigoureux des sciences physiques et naturelles, tels sont, théoriquement du moins, les principes fondamentaux du positivisme. Mais il faut ajouter que, dans la pratique, le fondateur du positivisme, s'il est à la rigueur resté fidèle au premier de ces principes (car sa religion de l'humanité était une religion sans Dieu), abusa singulièrement de l'abstraction métaphysique, et appliqua d'une manière fort insurfisante, arbitraire, les procédés des sciences d'observation. Tel fut Auguste Comte, tel fut son système.

II

L'expansion du positivisme.

Entre les circonstances qui aident à comprendre l'œuvre de Comte, et qui ont favorisé la diffusion de sa doctrine philosophique et sociale, il y a lieu de noter tout d'abord ses relations de jeunesse avec la secte saint-simonienne. Au sortir de l'Ecole polytechnique, Comte s'était attaché à Henri de Saint-Simon, ce " réformateur abondant et tumultueux ", comme le désigne M. Faguet, "qui avait chaque matin un projet de reconstitution du monde entier sur de nouvelles bases."[2]

L'idée fixe de Saint-Simon, à travers bien des incohérences, fut toujours d'établir un nouveau pouvoir spirituel; en d'autres termes, de faire table rase des croyances et institutions anciennes de l'humanité au profit de ses propres conceptions. Dès 1803, dans les *Lettres d'un habitant de Genève à ses contemporains*, il propose de créer "un grand conseil de l'intelligence, composé de douze savants et de neuf artistes, pour gouverner les âmes d'Occident." En 1825, peu de temps avant sa mort, il aspire à instituer la religion de l'avenir, un "Nouveau Christianisme."[3]

En 1817, l'année même où Augustin Thierry, le futur historien, se séparait de Saint-Simon, Auguste Comte s'attachait au précurseur du mouvement socialiste français, devenait son secrétaire, "son dic-

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[1] Mill, *Comte and Positivisn.*, p. 15, 123, 153, 171, 178-179, 193, 194.

[2] *Politiques et moralistes*, t. II, p. 282.

[3] *Id., ibid.*, p. 3.

tionnaire intelligent, toujours ouvert aux recherches et sachant les éclairer."[1] Comte est bientôt chargé de formuler la doctrine professée par l'école saint-simonienne; et il le fait dans une œuvre que Saint-Simon déclare ne pouvoir approuver entièrement, la part faite au sentiment religieux n'y étant pas à son gré assez grande.

Après la mort de Saint-Simon (1825), ses disciples restèrent groupés quelques temps et fondèrent le journal le *Producteur.* Puis une scission se produisit; le plus grand nombre des sectateurs forma une sorte d'association religieuse sous la direction de deux chefs spirituels ou Pères: Bazard, Enfantin (1829); d'autres, parmi lesquels Auguste Comte et Philippe Buchez, ne voulurent pas reconnaître l'autorité des nouveaux grands prêtres. Mais, tandis que Buchez[2] se sépara de Saint-Simon pour redevenir catholique, Auguste Comte n'en retint que l'idée qu'il tenta de réaliser vers la fin de sa vie, d'une religion entièrement fondée sur la science.[3]

La renommée tapageuse de la secte saint-simonienne aida, sans doute, à faire connaître l'œuvre d'Auguste Comte. Notamment, c'est par l'intermédiaire du saint-simonisme et d'un de ses fervents, Gustave d'Eichthal, que Stuart Mill fut, dès 1828, mis au courant des travaux de Comte. La révolution de 1830 venait à peine d'éclater que Stuart Mill accourut à Paris et se fit présenter aux chefs de l'école saint-simonienne. En 1837, il se procure les deux premiers volumes du *Cours de philosophie positive*, et s'assimile avidement le contenu des suivants au fur et à mesure de leur publication. En 1841, il engage avec Comte une correspondance qui s'est poursuivie activement pendant plusieurs années, et il se fait en toute circonstance, et surtout dans son grand ouvrage sur la Logique, paru en 1843, et devenu rapidement célèbre, l'ardent protagoniste de la philosophie positive.[4]

C'est surtout par l'intermédiaire de Stuart Mill que le public anglais a été initié à la philosophie positive; et Comte a eu un cercle de lecteurs et d'admirateurs en Angleterre avant même d'en avoir en France. Directement ou indirectement, c'est grâce à Stuart Mill que Grote, Molesworth, Lewes, Bain, Miss Martineau, Spencer même, se sont intéressés aux travaux du philosophe français; et ce sont les subventions de deux ou trois amis de Mill qui ont permis à

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[1] *Id., ibid.*, p. 282.

[2] Fondateur de l'*Européen*, auteur de divers travaux historiques, entre autres d'une volumineuse *Histoire parlementaire de la Révolution*, écrite en collaboration avec Roux-Lavergne, et propagateur d'une nouvelle théorie providentielle de l'histoire.

[3] V. de Clercq; *Les doctrines sociales en France depuis la Révolution*, t. I., p. 44, 45.

[4] Mill, *Autobiography*, p. 166; Thouverez, *Stuart Mill*, p. 12, 14, 15.

Comte de tenir tête pendant un an ou deux aux menées d'Arago et de son groupe de l'Ecole polytechnique.[1]

Au fond, Stuart Mill n'est pas mieux disposé que ne l'est Auguste Comte envers la foi religieuse; il n'est pas plus respectueux que lui des traditions sociales. A certains égards même, il l'est moins, car il est partisan du divorce qu'Auguste Comte condamne inexorablement. Soumis dès son jeune âge à un entraînement très spécial par son père le philosophe James Mill,[2] formé à l'école de Hobbes, de Locke, de Hartley, de Hume, de Bentham et de son propre père, Stuart Mill était certes un esprit émancipé. Le 15 décembre 1842, il écrivait à Comte qu'il n'avait jamais cru en Dieu, même dans son jeune âge. Le mois suivant, il lui signale "l'idée profondément irrationnelle d'une Providence agissant par des lois générales, et il ajoute: "Un des fondements principaux de cette philosophie (positive) est la loi naturelle du décroissement spontané de l'esprit religieux." Le 13 mars 1843, Mill exprime l'espoir que son livre, récemment paru, "pourra devenir un vrai point de ralliement philosophique pour cette partie de la jeunesse scientifique anglaise qui ne tient pas beaucoup aux idées religieuses." Le 20 août de cette même année, il écrit à Comte que le jeune Bain, qui vient de consacrer avec lui trois mois à l'étude du *Cours de philosophie positive*, "avait reçu de son éducation écossaise de fortes impressions religieuses qui, bien que déjà un peu affaiblies, n'ont réellement cédé qu'à l'influence directe de vos spéculations." Le 3 avril 1844, Mill affirme de nouveau que "l'attribut caractéristique de la nouvelle philosophie, c'est son incompatibilité radicale avec toute théologie quelconque."[3]

Seulement, le milieu anglais dans lequel opère Stuart Mill lui impose certains ménagements. "Vous n'ignorez pas, sans doute, écrit-il à Comte, le 18 décembre 1841, que chez nous l'écrivain qui avouerait hautement ses opinions anti-religieuses ou même anti-chrétiennes, compromettrait non seulement sa position sociale, que je me crois capable de sacrifier à un but suffisamment élevé, mais aussi, ce qui serait plus grave, ses chances d'être lu."—"Le temps n'est pas venu. lui écrit-il le 3 avril 1844, où, sans compromettre notre cause, nous pourrons en Angleterre diriger des attaques ouvertes contre la théologie même chrétienne." Le 27 janvier 1845, il revient sur le sujet. L'action de la philosophie positive sur les penseurs isolés "serait plus gênée que hâtée, dit-il, par une tentative quelconque de constituer publiquement une école anti-religieuse . . . et

[1] *Lettres*, p. 6, 36; *Autobiography*, p. 277-278.

[2] Naguère pasteur presbytérien en Ecosse et qui par la suite, ayant renoncé à toute croyance religieuse ou spiritualiste, devint l'instaurateur en psychologie de la théorie moniste de l'associationisme.

[3] *Lettres*, p. 135, 153, 166-167, 241, 307, 346.

donnerait probablement une nouvelle force à la réaction religieuse." Et le 8 juillet de la même année: "Aujourd'hui je pense qu'il faudrait en écrivant pour l'Angleterre se taire absolument sur la question religieuse, sauf à porter aux croyances religieuses tel coup qu'on voudra."[1]

L'habitude de la réserve imposée à Mill par son milieu social, et sans doute aussi l'expérience de la vie, dont il écouta toujours les leçons avec respect, modifièrent à la longue sa mentalité et lui inculquèrent une certaine considération, des égards plus sincères pour les croyances religieuses. Il n'en fut pas moins dans toute son œuvre un radical, le porte-parole de l'opinion sociale, de la pensée philosophique la plus avancée dans son pays.

Après Stuart Mill, celui qui contribua le plus à faire connaître en Angleterre le positivisme à ses débuts, fut sans contredit H. G. Lewes, qui, dès 1845, publiait sa première œuvre importante sous ce titre significatif: *Biographical history of philosophy from Thalès to Comte.* Ecrivain brillant, remarquable par l'envergure de son esprit et la variété de ses talents, Lewes se signala particulièrement par l'audace avec laquelle il brava l'opinion dans ses écrits, aussi bien que dans sa conduite. On connaît l'histoire de ses relations avec Mary Ann Evans, autre adepte de la philosophie de Comte, mieux connue dans la littérature anglaise sous son pseudonyme de George Eliot. Comte ne paraît pas avoir attaché une grande importance à l'adhésion de Lewes, encore jeune homme lorsqu'il fit sa connaissance, en 1842, et qu'il considérait plutôt comme simple littérateur, ou psychologue.[2] Il conçut de plus grandes espérances lorsque Mill lui apprit l'année suivante la conquête qu'il pensait avoir faite d'Alexander Bain, jeune professeur de l'université d'Aberdeen,[3] et surtout lorsque Littré, à l'occasion d'une série d'articles qu'il publiait dans le *National* en 1844, annonça son adhésion à la nouvelle doctrine philosophique.[4]

Littré, né en 1801, n'avait que trois ans de moins que Comte et, lorsqu'il donna son adhésion au positivisme, jouissait déjà d'une grande réputation dans le monde scientifique. Même en 1839, avait commencé à paraître sa traduction des *Oeuvres* d'Hippocrate, en dix volumes, dont le dernier devait paraître en 1861. Il allait bientôt donner la traduction du *Manuel de physiologie* de Muller et de l'*Histoire naturelle* de Pline, et, en collaboration avec le Dr. Ch. Robin, une refonte du *Dictionnaire de médecine* de Nysten, en attendant qu'il publiât son *Histoire de la langue française* (1862) et son grand *Dictionnaire de la langue française* (1873).

[1] *Lettres*, p. 13, 307, 403-404, 447, 448.

[2] *Lettres*, p. 63-64, 69, 224-225, 230.

[3] *Ibid.*, p. 241, 356.

[4] *Ibid.*, p. 367, 371, 374, 375, 383.

Mais Emile Littré, chercheur infatigable, doué d'une puissance de travail extraordinaire, était d'un radicalisme scientifique des plus prononcés, ennemi juré de tout clergé et de toute croyance religieuse. Une de ses premières œuvres avait été la traduction de la *Vie de Jésus* par Strauss (1839-1840), œuvre où le Christ est considéré comme un mythe. Dans son dictionnaire de médecine, il avait inscrit cette définition de l'homme: "Animal mammifère, de l'ordre des primates, famille des bimanes, etc." Encore en 1870, il se fit beaucoup de bruit à l'occasion d'un article qu'il publia sur *Les origines organiques de la morale.* Les phénomènes moraux, suivant Littré, ont une double source: l'instinct de la nutrition, qui est le principe de l'égoïsme, et l'instinct sexuel, qui est la source de tout altruisme.[1] L'Académie française, qui, en 1863, avait écarté sa candidature, à la suite de la dénonciation violente de Mgr Dupanloup, l'élisait en 1871, en dépit des protestations de ce dernier, qui refusa de siéger en sa compagnie. En 1875, suivant M. H. Marion, auteur de la notice dans la *Grande encyclopédie*, "son horreur de la réaction cléricale l'avait décidé à se faire recevoir franc-maçon." Gambetta et Paul Bert se proclamaient ses disciples, et c'est surtout par leur entremise que s'exerça l'influence de Littré sur la politique.

L'adhésion de Littré se produisit à un moment critique dans la carrière de Comte, comme s'engageait entre celui-ci et les représentants de la science officielle en France une lutte impitoyable; et si le positivisme a pu traverser cette crise, et même étendre le cercle de son action, c'est surtout à Mill et à Littré qu'il le doit.

Autour d'Auguste Comte il s'était formé graduellement un groupe de disciples et de fervents de composition très variée; des médecins (sans parler de Littré et de son collaborateur Charles Robin) comme les docteurs Robinet, Audiffrent, Sémérie, Dubuisson, L. A. Segond, etc; des ouvriers, comme le menuisier Magnin; des prolétaires même, comme Finance et Keyfer; des aristocrates, comme le comte de Limbourg-Stirum et le baron de Constant-Rebecque; des avocats ou littérateurs, comme les Foucart, Emile Antoine, Camille Monier, Poëy, etc; l'agronome Hadéry, l'agent de change Lonchampt, et enfin Pierre Laffitte, qui devait succéder à Comte comme chef du positivisme orthodoxe.[2]

Mais, c'est surtout à l'influence de Littré que le positivisme est redevable de sa diffusion sur tous les points du globe. Le R. P. Gruber, jésuite allemand, auteur de deux volumes très documentés sur Comte et son école, constate que le positivisme de Littré "a eu

[1] R. P. Gruber, S. J.; *Le positivisme depuis Comte jusqu'à nos jours*, Paris, Lethielleux, 1893, p. 38-39.

[2] Dr. Robinet, *Philosophie positive*, Paris, Alcan, p. 98, 99 (note); Gruber, *ouvr. cit.* p. 93 et suivantes.

un succés éclatant . . . Pendant longtemps Littré a joui en France de la plus grande célébrité: la presse littéraire et scientifique lui a donné une importance vraiment gigantesque. La revue la *Philosophie positive* prouve que le positivisme de Littré a, non seulement trouvé crédit auprès des libres-penseurs de France, mais qu'il a pénétré, qu'il a parfois trouvé un grand retentissement, en Espagne, en Portugal, en Angleterre, en Allemagne, en Autriche et en Italie, en Hollande et en Belgique, en Russie et en Turquie, en Suède et en Norvège, dans l'Amérique du nord, dans l'Amérique centrale, dans l'Amérique du sud, et jusqu'en Syrie, en Arménie et au Japon".[1]

Il fut un moment où les positivistes purent se donner l'illusion d'avoir implanté leur doctrine dans à peu près tous les centres de la civilisation.[2]

III.

La faillite du positivisme.

Mais ce n'était qu'une illusion. De fait, cette rapide expansion du positivisme eut l'effet de précipiter sa ruine et de la rendre plus complète. L'insuccès fut éclatant à tous égards. En premier lieu, Comte et ses disciples ne réussirent nullement à constituer ce pouvoir spirituel que la philosophie positive avait pour première et principale mission d'instituer. Comme discipline intellectuelle ou morale, les docteurs positivistes n'exercèrent jamais sur un groupe quelconque qu'une autorité fort restreinte et éphémère. Même, en aucun temps ils ne surent maintenir dans leur propre cénacle l'union et l'harmonie. L'histoire du positivisme est faite en grande partie du récit de ses dissensions intestines.

A peine l'alliance entre Comte et Mill s'est-elle fondée sur les protestations d'amitié les plus vives, que de profondes divergences éclatent. Mill juge Comte trop entier et autoritaire; Comte juge Mill trop libertaire et trop imbu de l'ancien esprit métaphysique. Tout rapport cesse entre eux dès 1847, par suite, nous dit Stuart Mill,

[1] Gruber, *Le positivisme*, p. 53.

[2] De nombreux écrivains, recrutés en maint pays d'Europe et d'Amérique, et dans tous les camps de l'opinion, ont contribué leur quote-part à la publicité du positivisme. Une liste d'ouvrages relatifs au positivisme, parus surtout en France et en Angleterre de 1842 à 1882, liste que je me suis dressée au courant de mes lectures et sans faire de recherches spéciales, et dès lors nécessairement fort incomplète contient au delà de soixante-dix titres. En d'autres termes, durant cette période, il ne s'est guère passé d'année sans qu'il parût au moins un ouvrage important, et quelquefois deux ou trois, approuvant ou critiquant les doctrines de Comte ou de son école.

de dissentiments profonds portant sur les tendances, et non pas seulement sur les doctrines.[1]

L'accord entre Comte et Littré ne fut pas plus durable. Celui-ci voulait orienter le positivisme dans le sens exclusivement scientifique, au moment où Comte aurait voulu le frotter de mysticisme. A la suite de tiraillements assez pénibles, la rupture devint définitive en 1852.

Le fondateur du positivisme n'eut pas de rapports plus cordiaux avec ses autres collaborateurs principaux. Il fait allusion à de Blignières en termes peu flatteurs, et qualifie ironiquement de " disciples intellectuels " Lewes et ses autres adhérents anglais de la première heure. Comte mort (1857), Pierre Laffitte, naguère disciple favori du maître, mais dont celui-ci ne voulait plus comme successeur, fut élu pour le remplacer. Aussitôt le nouveau grand prêtre se trouve en lutte, d'une part, avec Littré, qui ne veut conserver du positivisme que son esprit pseudo-scientifique, et, d'autre part, avec Audiffrent, Lagarrigue, Lemos, qui abondent dans le sens du mysticisme. Même Littré et Mill sont loin de s'entendre et engagent des polémiques. Entre temps, il se forme en Angleterre un nouveau groupe d'adhérents de Comte, grâce surtout à l'initiative de Richard Congreve, ancien ministre anglican et professeur d'Oxford. Ici encore le pouvoir spirituel fait long feu, et Congreve, après s'être séparé avec éclat de Laffitte, se voit abandonné par nombre de ses collègues les plus importants: Bridges, Harrison, Beesly, etc.[2]

Dans la pensée de Comte, l'établissement de ce nouveau pouvoir spirituel était lié à la destruction de l'esprit théologique et de l'esprit métaphysique, comme aussi à l'élaboration et à la diffusion d'une philosophie positive embrassant et résumant tout le savoir humain. Inutile de dire qu'aucun de ces projets n'eut sa réalisation.

La croyance au surnaturel, le prestige des religions anciennes, l'autorité même du clergé catholique, ne furent que bien faiblement entamés par la croisade positiviste. Aussi bien, les deux chefs du positivisme en France en ont fait en quelque sorte l'aveu, chacun à sa manière. L'année même de sa mort (1857), Comte, peu satisfait, sans doute, des progrès accomplis jusque là par sa grotesque religion de l'humanité, conçut le projet étonnant de conclure une alliance avec la Compagnie de Jésus. Par l'entremise de son disciple Sabatier, qui vivait alors exilé en Italie, il entama des négociations

[1] Mill, *Autobiography*, Londres, 1873, p. 211; *Lettres* Mill-Comte, préface, p. I et II.

[2] Mill, *Comte and Positivism*, p. 127; Caro, *Le matérialisme et la science*, p. 21, 59, 79, 88, 95 (note), 169 et suiv., 200 et suiv; Gruber, *Le positivisme*, p. 86, 201; Frederic Harrison, *Autobiographic Memoirs*, Londres, Macmillan, 1911, t. II, p. 258-259.

auprès du général des Jésuites à Rome. "A l'avenir, écrit le R. P. Gruber, les Jésuites s'appelleraient Ignatiens, leur général se proclamerait chef de l'Eglise catholique, il ferait du pape le prince-évêque de Rome, et fixerait se résidence à Paris, nouvelle métropole spirituelle.... Comte et le Général Beckx travailleraient en commun à éliminer le protestantisme, le déisme et le scepticisme.... Ensemble ils établiraient le pouvoir spirituel."

Les Jésuites, dont Auguste Comte avait naguère stigmatisé la "politique absolument hyprocrite et machiavélique", ne se hâtèrent pas trop de répondre à la lettre de Sabatier, et lorsque celui-ci se présenta à la demeure du Général, il fut reçu par le P. Rubillon, assistant des provinces de France, qui commença par lui expliquer qu'il " ne soupçonnait même point l'existence du célèbre philosophe ". " A toutes les propositions (dit Sabatier) il fut répondu poliment mais invariablement: les Jésuites ne sont que de pauvres religieux qui ne s'occupent nullement de politique. Entre les membres d'un ordre qui a Jésus-Christ pour centre de son existence et ceux qui nient la divinité de Jésus-Christ, aucune alliance religieuse n'est possible."[2] Comte et ses amis durent s'apercevoir que, si les Jésuites ne se mêlent pas de politique, du moins ils ne sont pas dépourvus de sens pratique.

Dix-huit ans plus tard, Littré confessait à son tour, d'autre manière, l'échec subi par le positivisme dans sa lutte contre le " théologisme ": en 1875, déjà très âgé, et mû, nous dit son biographe M. Marion, par " son horreur de la réaction cléricale, il se faisait recevoir franc-maçon ". Et c'est le F. Jules Ferry qui se chargea, lors de l'anniversaire de l'initiation du F. Littré, de rappeler " ce grand fait maçonnique... l'entrée officielle du positivisme, par un de ses représentants les plus illustres, dans le sein de la maçonnerie ", et qui signala " l'affinité intime, secrète, entre la maçonnerie et le positivisme ".[3]

Mais si Emile Littré, après trente-cinq ans d'active propagande positiviste, crut devoir consommer une alliance entre le pouvoir spirituel de sa secte et la maçonnerie, agent subreptice et effectif de la faction politique dominante, et cela en dépit de la règle inviolable posée par Comte quant à la séparation des deux pouvoirs, n'était-ce pas reconnaître l'insuccès des efforts dirigés jusque là par le positivisme contre les religions établies? Quand on est fort et qu'on a conscience de sa force, on ne se ligue pas pour combattre un groupe ou une institution, à moins que ce groupe ne soit formidable, ou cette institution florissante encore.

[1] Gruber, *Aug. Comte, sa vie et sa doctrine*, Paris, 1892, p. 288-290.

[2] *Id., ibid.*, p. 290-291.

[3] *Grande encyclopédie*, verbo *Littré*; Gruber, *Le positivisme* p. 64, 65.

La guerre faite par le positivisme à la métaphysique n'eut pas un meilleur succès. Comte pensait pouvoir se passer de toute métaphysique, mais, par une contradiction qui s'observe assez fréquemment chez ces esprits entiers, il s'empressa d'en fabriquer une à son usage. Elle s'étale dans toutes ses œuvres. Et cette prétention, comme cette métaphysique, de Comte n'a pas été l'objet d'un accueil très favorable, même de la part d'esprits par ailleurs très sympathiques: déterministes, psychologues, rationalistes-objectivistes.[1]

Le résultat le plus tangible de la campagne menée contre le théologisme, ainsi que de l'établissement du culte de l'humanité, avait été d'exposer au ridicule Comte et sa philosophie; son parti pris d'exclure toute métaphysique, et notamment la notion de cause, eut l'effet de le déprécier dans l'estime des savants. Et son système de philosophie positive, qu'il rêvait d'établir sur les ruines de toute théologie et de toute métaphysique, il ne sut pas lui donner une base assez large et assez ferme pour le rendre acceptable aux savants.

Le dernier volume du *Cours de philosophie positive* n'avait pas encore vu le jour que déjà son auteur se trouvait en butte aux attaques de la science officielle, ainsi que de spécialistes éminents à la fois en France et en Angleterre. On sait quelle guerre cruelle lui firent Arago et ses amis, à l'Académie des sciences et à l'Ecole polytechnique. Or, il ne faudrait pas croire que l'opposition faite à Comte eût sa source principale dans des animosités personnelles, ou des rivalités entre factions. Comte se plaint à Mill le 4 mars 1842, de ce que " les savants français enrégimentés lui sont à quelques exceptions près essentiellement hostiles ". Mais il y a lieu de noter qu'en Angleterre Herschell, fils de l'astronome et grand astronome lui-même, Sedgwick et Whewell, professeurs à Cambridge, ce dernier, auteur de l'*Histoire des sciences inductives*, œuvre très estimée, ne lui sont pas plus favorables.[2] Et un savant très consciencieux de la génération suivante, et qui n'a été nullement mêlé aux querelles des contemporains de Comte, Stanley Jevons, a de graves réserves à faire sur l'attitude scientifique de Comte. Il lui reproche ainsi qu'à Mill de toujours écrire comme si notre connaissance du monde en épuisait presque le contenu, au lieu de ne représenter qu'une infime proportion de la réalité.[3]

L'opposition faite à Comte et à son système ne saurait davantage se ramener à une querelle entre classes de spécialistes scientifiques.

[1] Taine, *Correspondance*, t. II, p. 258; Picard, *De la méthode dans les sciences*, p. 12; Durkheim, *Règles de la méthode sociologique*, p. VIII.

[2] *Lettres* Mill-Comte, p. 36, 366, 466, 469, 471, 473, 479, 527; Huxley, *Scientific aspects of positivism*, dans *Lay sermons*, Macmillan, 1870, p. 171, note; Bain; *Stuart Mill, A criticism*, p. 81.

[3] W. S. Jevons, *Principles of Science*, p. 752, 768.

Il est vrai que le fondateur du positivisme a eu pour adversaires, au début, surtout des mathématiciens. Comte, pourtant mathématicien lui-même par profession et par vocation, pose parfois en champion des biologistes contre les "géomètres."[1] Mais encore ici il ne faut pas perdre de vue que les biologistes eux-mêmes, surtout ceux de la nouvelle génération, ne voulurent pas reconnaître Comte comme leur champion, et cela pour la meilleure des raisons son insuffisante maîtrise de la biologie et des principes généraux de la science. Entre tous, Huxley, le fougueux paladin de l'évolutionnisme, dès 1854, et de nouveau en 1868 et 1869, relevait avec sa verdeur ordinaire, les insuffisances du fondateur du positivisme au point de vue scientifique. "Depuis seize ans, écrit-il en 1869, j'ai eu le déplaisir à mainte reprise de voir mettre M. Comte de l'avant comme interprète de la pensée scientifique." De l'avis de Huxley, c'est l'esprit scientifique même qui fait défaut à Comte.[2]

L'attitude de Bain est aussi très suggestive. Il s'était initié à la philosophie positive sous la direction de Stuart Mill, et Comte, aussi bien que Mill, fondait sur lui les plus grandes espérances. Mais une fois que Mill eut rompu ses relations avec Comte, Bain absorbé désormais par ses recherches de psychologie objective, ne s'est plus occupé de Comte. Dans l'ouvrage important que Bain publia à Londres dès 1855, *The Senses and the Intellect*, le nom de Comte n'apparaît pas, non plus, du reste que dans ses livres subséquents: *The Emotions and the Will* (1859), et *On the study of character* (1861). Dans ce dernier ouvrage, notamment, Bain discute les vues de Gall, de Stuart Mill, de La Bruère, et même de cet excentrique de Ch. Fourier, mais de Comte, pas un mot. C'est que, surtout depuis la publication de sa *Politique positive* (1851-1854), la réputation de Comte était décidément à la baisse dans les milieux scientifiques, et un jeune auteur aurait pu compromettre le succès de son œuvre en se réclamant de lui, ou même en laissant croire qu'il avait un jour subi l'influence d'un tel maître.

En effet, aux yeux des hommes de science comme aussi des philosophes de la nouvelle génération, la faute impardonnable de Comte était d'avoir voulu leur imposer le joug d'un système rigide, définitif, de connaissances, fondé sur l'état des études vers 1830, sans tenir compte de la possibilité de découvertes futures. Non seulement le fondateur du positivisme jugeait-il intangible son exposé de la science actuelle, mais il prenait sur lui de règlementer la marche ultérieure de l'investigation scientifique, et d'avance déclarait oiseuses toutes recherches relatives à certains sujets. Malheureusement pour lui,

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[1] *Lettres*, p. 148, 151.

[2] *Lay sermons*, p. 88-89, 153-154, 162 et suivantes.

la fausseté de ses prévisions fut en plus d'une circonstance promptement et irréfutablement établie du fait de découvertes inespérées. En 1835, il refusait tout caractère de certitude scientifique aux recherches d'astronomie sidérale.[1] Il les condamnait comme dépourvues de tout intérêt pratique.

Or, en 1839, Bessel lui infligeait un cruel démenti en mesurant la parallaxe de l'étoile 61 de la constellation du Cygne. Désormais, on était à même de calculer avec exactitude la distance de la terre aux étoiles. Et grâce aux progrès, aux nouvelles applications de l'analyse spectracle, on put avant bien longtemps se rendre compte de la présence ou de l'absence de certains éléments chimiques dans ces astres éloignés. Trois ans à peine après que le fondateur du positivisme eut condamné la théorie de la composition cellulaire des corps organisés, Schwann et Schleiden faisaient la constatation directe de son exactitude à l'aide du miscroscope.[2] Comte ne sut pas davantage apprécier à leur juste valeur les recherches et les découvertes relatives au développement et à l'évolution des organismes vivants. Enfin, comme je l'indiquerai plus particulièrement un peu plus loin, on ne saurait prétendre que le fondateur du positivisme, ou aucun de ses continuateurs, ait réellement constitué la science sociale.

Comte n'a été l'homme d'aucune science; il n'a voulu être que le philosophe des sciences; il n'a pas été autre chose; et encore sa philosophie des sciences n'a-t-elle exercé sur les esprits qu'une action assez restreinte et passagère. En vain Littré a-t-il dépouillé le positivisme de l'appareil mystique dont Auguste Comte l'avait affublé vers la fin de sa vie; en vain a-t-il consommé son alliance avec la franc-maçonnerie politique; en vain Laffitte, successeur de Comte en France, et Harrison, son continuateur en Angleterre, se sont-ils efforcés de rendre le positivisme moins rébarbatif au sens commun, plus acceptable aux gens du monde; la génération nouvelle se détourne de plus en plus de lui, et l'inauguration officielle d'une statue de Comte à Paris en 1902, ne saurait compenser le délaissement de sa doctrine dans le monde de la pensée.[3]

Deux ans à peine après la mort de Littré, la revue la *Philosophie positive* cesse de paraître (1883), et ses directeurs Wyrouboff et Ch. Robin, dans leurs adieux aux lecteurs, s'expriment en ces termes: "Nous disparaissons devant l'indifférence générale pour les questions philosophiques." Même cet aveu n'est pas complet, s'il faut en croire la *Revue philosophique*, laquelle affirme à ce propos que la revue la

[1] *Cours de philos. posit.*, t. II, p. 363-366.

[2] Fiske, *Cosmic philosophy*, t. I, p. 247, 248, 249, 251.

[3] Sur Laffitte, consulter Gruber, *Le positivisme*, p. 86, 87, 89-93, 202; sur Harrison, consulter ses propres ouvrages, entre autres *The creed of a layman* et *The philosophy of Common sense*, Londres, Macmillan.

Philosophie positive, trop strictement attachée à la doctrine de Comte, a disparu, non devant l'indifférence, comme elle le dit, mais parce qu'elle a été débordée par un mouvement philosophique beaucoup plus large."[1]

"La doctrine comtienne, écrit M. Emile Picard, la doctrine comtienne, qui ne s'embarrasse d'aucune analyse délicate, paraît assurément simple, mais est singulièrement superficielle . . . Sa vision statique d'une science qu'il souhaite voir promptement définitive est pour nous inadmissible . . . Le positivisme trop simpliste de Comte a besoin d'être élargi par une analyse plus complète."[2] Le positivisme de Comte et de Littré a été submergé par la marée montante de l'évolutionnisme de Spencer, sorte de positivisme agrandi, embrassant le cosmos (tandis que l'autre ne s'inquiétait guère que de notre terre et de l'humanité), positivisme moins entier, moins immobile aussi, faisant la part de l'Inconnaissable, c'est-à-dire de ses propres limitations.[3]

Et ce positivisme plus large, mieux renseigné, moins tyrannique, n'a pas envahi seulement le monde anglo-saxon, il a remporté ses succès les plus éclatants et les plus durables dans la patrie même du prédécesseur que, sans façon, il met au rancart. "C'est de l'Amérique, de l'Inde, du Japon, que la réputation est venue d'abord à Herbert Spencer," écrit M. Gaston Rageot; "c'est en France, surtout, qu'il s'est maintenu et accrédité."[4]

Bientôt à son tour l'évolutionnisme de Spencer se verra supplanté par un jeune et formidable adversaire, le pragmatisme de James et de Bergson. C'est James qui fait de Spencer cette appréciation: "Chez Spencer apparaît un nombre effrayant de lacunes. On connaît son tempérament de maître d'école, sa sécheresse; on connaît sa monotonie, rappelant celle d'une vielle; on connaît sa prédilection pour les expédients qui ne coûtent pas cher en matière d'argumentation; on connaît son manque de culture jusque sur les principes de la mécanique, et le vague de ses idées fondamentales; on sait enfin tout ce qu'il y a de raide et de gauche, en même temps que de fragile, dans son système, construit, semblerait-il, avec des planches de sapin toutes fendues qu'on aurait assemblées à grands coups de marteau."[5]

Et le pragmatisme a de la vogue . . . . en attendant que cette philosophie nouvelle se soit discréditée à son tour par l'exagération de son principe fondamental. L'empirisme radical et l'anti-

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[1] Gruber, *Ouvr. cit.* p. 78-79.

[2] *De la méthode*, p. 12.

[3] Fiske, *op. cit.*, t. I, p. VIII, IX, 132 et suiv., 136, 138, 175, 261-262; t. II, p. 74-75, 81, 487, 488.

[4] Gaston Rageot, *Les savants et la philosophie*, Paris, Alcan, 1908 p. 13.

[5] Wm. James, *Le pragmatisme*, Paris, Flammarion, p. 51-52.

intellectualisme peuvent bien être les signes prémonitoires d'une imminente sénilité.[1]

IV.

Les aventures de la sociologie (le mot).

La sociologie, discipline dernière et suprême du positivisme de Comte, a une histoire à elle, assez différente de celle de l'ensemble du système. Au début, la vulgarisation de la sociologie paraît être en retard sur celle de la philosophie positive dans ses grandes lignes; puis, c'est la sociologie qui gagne rapidement du terrain, tandis que le positivisme passe à l'arrière plan. Aujourd'hui, comme secte et comme école, le positivisme est visiblement à son déclin, tandis que la sociologie brille encore d'un vif éclat. Afin de nous rendre compte de ce qu'il y a de réel et de ce qu'il y a de faux dans cet éclat, nous ferons bien de distinguer dans la sociologie le mot de la chose. Et d'abord le mot.

Le dernier volume du *Cours de philosophie positive* de Comte, parut en 1842. Dans son traité de Logique, dont la première édition est de 1843, Stuart Mill, alors admirateur enthousiaste du philosophe français, fait un assez bon accueil au terme nouveau. Le néologisme "sociologie," dont on se sert pour désigner la science sociale, écrit-il, est un barbarisme, mais un barbarisme d'un usage commode.[2] La propagande assez active en faveur de la philosophie nouvelle, menée de front, en France par Comte et Littré, en Angleterre par Mill, Lewes, Miss Martineau, aida accessoirement à vulgariser "sociologie."

Cependant, le terme nouveau ne s'est, semble-t-il, acclimaté en France qu'assez tardivement. J'ai sous les yeux le catalogue de la section de sociologie de la bibliothèque du parlement fédéral à Ottawa, préparé à l'origine par Errol Bouchette, et tenu à jour par son digne successeur, M. Oswald Soulières. Dans la partie de ce catalogue où les ouvrages sont inscrits suivant l'ordre chronologique de leur première publication, on constate que jusqu'en 1889, aucun titre d'ouvrage ne porte la mention de "sociologie", tandis que plusieurs reproduisent le terme ancien de "science sociale". Le grand dictionnaire de Littré, paru en 1873, donne la définition suivante du mot "sociologie": "Terme didactique, science du développement et de la constitution des sociétés humaines . . . Mot hybride, dû à Auguste Comte dans son système de philosophie positive. Il est pleinement entré dans l'usage." A ce dernier égard, il semblerait que Littré se fît un

[1] James, *Philosophie de l'expérience*, Paris, Flammarion, p. 280 et suiv.

[2] Logic, p. 619 de la 8e édition.

peu illusion; car cette année même, il paraissait à Paris une traduction française de l'ouvrage de Spencer "The study of sociology", et l'auteur de cette traduction française était loin de se douter apparemment que "sociologie", fût d'origine comtienne et française. Il donne pour titre à la version française: *Introduction à la science sociale*", et il ajoute en note: "Cet ouvrage était intitulé dans l'édition anglaise "*Study of Sociology*", littéralement l'*étude de la science sociale.*"[1]

Spencer et son école ont probablement plus que tous autres contribué à généraliser l'emploi du mot "sociologie", et cela, non seulement chez les peuples de langue anglaise, mais même en France, comme semble bien l'indiquer le petit fait relaté ci-dessus. De bonne heure, Spencer fut initié au système de Comte, sinon directement par la lecture des livres de ce dernier, du moins en conversation avec deux de ses propres amis, disciples de Comte, Mary-Ann Evans (George Eliot) et G. H. Lewes, comme aussi par la lecture des écrits de ce dernier et de ceux de Miss Martineau, auteur d'une traduction anglaise libre ou résumée du *Cours de philosophie positive.* Le mot "sociologie" figure dans ses premiers écrits, et notamment dans le prospectus de sa grande œuvre de *Philosophie synthétique* (1860), et "sociologie" a bénéficié de toute la vogue dont la philosophie de Spencer a joui pendant de longues années.

Il est assez curieux de voir Spencer dans ce rôle de principal propagateur du mot "sociologie", qu'il reconnaît avoir été inventé par Comte, lorsqu'on se rappelle qu'il s'est toujours énergiquement défendu d'être son disciple, ou même de lui être redevable d'un seul principe organique de sa philosophie. Il n'a jamais lu dans le texte, nous assure-t-il dans son *Autobiographie*, un seul des ouvrages de Comte. Il n'a connu que le résumé publié par Miss Martineau à l'usage du public anglais. Encore, de ce résumé, n'a-t-il pris connaissance que des premiers livres. Il n'a pas lu les parties traitant de la biologie et de la sociologie. En somme, si Comte lui a été de quelque utilité, c'est uniquement comme tête de turc: il n'a guère trouvé chez lui que des idées à réfuter.[2]

Pour ce qui est particulièrement de son adoption du mot "sociologie," Spencer s'en explique dans la préface de son volumineux traité (1876). Il a trouvé, écrit-il, ce vocable déjà en usage, et il l'a adopté, faute d'un autre terme suffisamment compréhensif. En effet, il juge trop étroit et imprécis le mot anglais "politics", mais ne dit rien du terme de "science sociale", qu'il n'est pourtant pas sans connaître. (Il est probable, du reste, qu'il aurait jugé la désignation choquante dans un exposé de philosophie synthétique.). On lui a

[1] *Introduction à la science sociale*, par Herbert Spencer, Paris, Alcan, p. 6.
[2] *Autobiography*, Londres 1904, t. I., p. 292 note, 515, 517, 518, 577-578.

reproché à mainte reprise d'avoir adopté ce terme de "sociologie", de composition bâtarde et vicieuse. Mais il n'attache guère d'importance à ce reproche. A son avis, la commodité du terme et sa parfaite propriété doivent l'emporter sur toute autre considération.[1]

Encore en 1889, un écrivain de marque en France, Fustel de Coulanges, dans la préface de son livre l'*Alleu et le domaine rural* (p. IV), parle avec humeur et une sorte de mépris de ce qui est toujours apparemment pour lui un néologisme: "On a inventé depuis quelques années, le mot "sociologie". Le mot "histoire" avait le même sens et disait la même chose, du moins pour ceux qui l'entendent bien. L'histoire est la science des faits sociaux, c'est-à-dire la sociologie même." N'est-ce pas l'invariable prétention du spécialiste, historien ou autre, de noyer la science sociale dans ce qui fait l'objet de ses études de prédilection ?

Mais déjà pour la sociologie commence une ère nouvelle. Sa vulgarisation va s'effectuer désormais beaucoup plus rapidement. La fondation de l'Institut international de sociologie, à Paris, date de 1893; elle est suivie de l'établissement de nombreuses sociétés de sociologie en Europe et en Amérique. La France (Paris 1895), la Belgique (1899), la Hongrie (Budapest 1900, Nagyvarad et Györ 1908), l'Italie (Palerme 1900, Catane 1908), l'Espagne (Madrid 1901), l'Angleterre (Londres 1903, Birmingham 1909), les Etats-Unis (1905), l'Autriche (Vienne 1907, Gratz 1908) l'Allemagne (Berlin 1909), s'adjoignent au mouvement. Le nombre des ouvrages en librairie qui portent en titre ou en sous-titre "sociologie" ou "sociologique" se multiplie singulièrement à partir de 1893. Bientôt on voit la sociologie figurer au programme de grands établissements d'enseignement public. Aux Etats-Unis, il existe déjà, en 1909, près de quatre cents de ces institutions où la sociologie est enseignée. Comme le déclare M. Durkheim, le mot "a aujourd'hui conquis droit de cité dans toutes les langues européennes".[2]

Même le lourd "Gesellschaft wissenchaft" des Allemands paraît devoir céder le pas devant le terme plus léger de "Soziologie" ou "sociologie."

Au point de vue religieux, comme au point de vue ethnique et national, le domaine de la sociologie s'est remarquablement agrandi. Du vivant de Comte, et même longtemps après, "sociologie" était en quelque sorte le mot de passe de tous ceux qui, au nom d'une philosophie quelconque, rejetaient toute tradition religieuse. La sociologie était la science sociale des "scientistes", par opposition à celle

[1] *Principles of Sociology*, Londres, Williams & Norgate, t. I., p. IX.

[2] L. F. Ward, *Proceedings of the American Sociological Society*, t. IV., p. 193; Durkheim, *De la méthode dans les sciences*, p. 307.

des théologiens. Mais depuis, ces étroites limites ont été renversées. Aujourd'hui, "sociologie" revient à tout instant sous la plume d'écrivains philosophes ou spécialistes scientifiques qui ne sont nullement hostiles, qui sont même franchement favorables aux idées chrétiennes et catholiques. Je signalerai particulièrement plusieurs auteurs dans la collection *Science et Religion*, comme l'abbé Naudet. M. Méline, etc., et certains collaborateurs de la *Science sociale*, comme M. Philippe Champault et M. Jean Périer, qui ont fait un fréquent usage, ces années dernières, du substantif "sociologie" et de son adjectif "sociologique".

Bien plus, toute une école de publicistes et de professeurs qui ne reconnaît la science sociale qu'à titre de déduction, ou de commentaire, de la morale de l'Evangile, des principes de la théologie catholique et des enseignements de l'Eglise, est devenue un des plus actifs agents de propagande du terme "sociologie". Des prêtres instruits' des théologiens de grande réputation, spécialement consultés à ce sujet, me répondent qu'ils n'ont vu dans les encycliques ni "sociologie" ni "sociologique", mais que ces mots sont monnaie courante pour tous religieux et écrivains catholiques adonnés aux études sociales. Il existe une "sociologie catholique"; elle s'enseigne spécialement à l'usage des fidèles comme aussi du clergé.

Au pied levé, lorsqu'on se rappelle les origines du mot, un tel fait est de nature à surprendre. " Dog should not bite dog ", écrit finement M. Harrison, pour expliquer la modération de ses réponses aux attaques de Stephen ou de Huxley.[1] Que les sociologues proprement dits soient profondément divisés d'opinion et se chamaillent entre eux, il leur reste toujours un terrain de commune entente: sauf de rares exceptions, ils sont d'accord qu'il y a lieu de faire table rase de tout le savoir humain et de toutes les traditions sociales au profit de leurs principes philosophiques, ou de leurs lois scientifiques, de découverte ou de résurrection récente. Au contraire, les néo-sociologues catholiques, par définition, tiennent résolument au primat de l'autorité et de l'enseignement de l'Eglise, même en matière scientifique. Qu'ils se soient à la onzième heure ralliés au cortége triomphal de la sociologie, voilà qui semble presque inexplicable.

Voyons pourtant s'il ne se trouve pas des faits propres à nous éclairer. A la lecture des lettres échangées entre Mill et Comte, on voit que les premiers positivistes furent, dès le début, l'objet d'un traitement plus généreux et sympathique de la part des catholiques et des conservateurs en général que de la part de l'élément librepenseur, révolutionnaire ou libéral.[2] Notamment le 26 avril 1845,

[1] *Philosophy of common sense*, p. 276.

[2] P. 415, 423-424, 435.

Mill écrit à Comte: " Nous avons obtenu vous et moi les honneurs d'une publicité assez éclatante par l'intermédiaire d'un des chefs de l'école anglo-catholique M. Ward, qui fit paraître, il y a une année ou davantage, un assez gros volume dans lequel il peignait en très noires couleurs l'état actuel de l'église anglicane et de la société anglaise, se déclarait nettement contre la réformation de Luther, et appelait l'église anglicane à rentrer dans le giron du catholicisme romain. Cet ouvrage fit grand scandale ici, et l'université d'Oxford vient de priver l'auteur de ses grades universitaires, comme ne faisant plus partie en droit de l'église anglicane."[1] Ward tance Auguste Comte encore plus vertement que Mill à cause de son irréligion, mais cite plusieurs passages de son livre, et fait l'éloge de ses capacités, et même de ses intentions. " Il dit, ajoute Mill, que vous reconnaissez avoir pris bien des choses dans de Maistre, mais qu'il vous trouve bien supérieur à ce penseur." La *Quarterly Review* reprochait à Ward d'avoir tiré plus d'enseignements de l'école Mill et de Comte que des théologiens anglicans.

Dans cette sympathie et ces égards témoignés pour l'école positiviste à ses débuts par un des chefs du mouvement d'Oxford et des néo-catholiques anglais, il ne faudrait pas voir un simple fait individuel, accidentel. M. Frederic Harrison, un des plus illustres champions du positivisme en Angleterre, et probablement le dernier, rappelle dans ses mémoires qu'il fut de longues années, ainsi que d'autres de son école, reçu dans l'intimité, et invité à la table du cardinal Manning. L'archevêque de Westminster lut avec intérêt l'introduction faite par Harrison au deuxième volume de la *Politique positive* de Comte, et il aimait à signaler les analogies profondes entre le catholicisme et le positivisme. M. Harrison déclare le rapprochement juste et conforme au jugement de Comte, si l'on s'en tient au moyen âge et à l'aspect moral plutôt qu'intellectuel de l'institution catholique.[2]

De même en France, plus d'un écrivain catholique montre un certain penchant pour le positivisme. Qu'on lise à ce sujet la préface intéressante, mais pleine de ménagements dont Léon Ollé-Laprune fait précéder le livre du P. Gruber sur Auguste Comte; aussi quelques pages de Brunetière au commencement de son livre *Les chemins de la croyance*. D'autre part, je relève dans la collection *Science et Religion* un petit ouvrage de M. Victor de Clercq, avocat à la cour d'Appel de Paris, lequel, après avoir brûlé son grain d'encens sur l'autel

[1] Wm. George Ward n'était pas encore définitivement passé au catholicisme. Son adhésion formelle eut lieu en septembre suivant, un mois avant celle de Newman Voir la *Catholic Encyclopedia*.

[2] Harrison, *Autobiographic Memoirs*, t. II, p. 88-89.

d'Auguste Comte, se mêle, de sa propre autorité, d'excommunier les principaux collaborateurs de la *Science sociale*. " On a dit beaucoup de mal du positivisme, écrit-il, et assurément il est facile de montrer les contradictions intrinsèquement contenues dans la théorie philosophique de Comte. Toutefois, beaucoup ne l'ont jugée si sévèrement que pour l'avoir entrevue à travers les déformations que lui firent subir Littré et d'autres disciples infidèles, qui du système ne retinrent qu'une partie, et peut-être la plus choquante. Médiocre philosophe, Comte reste un éminent sociologue... Il eut surtout le grand mérite de vulgariser les idées de réorganisation sociale déjà exprimées par Saint-Simon...[1]

Quant aux directeurs et collaborateurs de la *Science sociale*, au jugement de M. de Clercq, " ils professent avant tout le culte du " moi " et de la force; leurs conceptions sociales ne sont plus chrétiennes".[2] Or, apparemment, cette belle indignation, ces téméraires jugements sont provoqués uniquement par l'attitude irréprochable des collaborateurs de la *Science sociale* qui, se fondant sur l'observation de faits anciens et nouveaux, prônent l'initiative privée et locale de préférence à l'intervention de l'Etat en matière économique et sociale, et se montrent mal disposés à seconder les efforts de certains catholiques dont le rêve est de rétablir les corporations ouvrières et autres institutions du moyen âge.

On s'expliquera assez bien cette conduite, tant des catholiques anglais que des catholiques français, à l'égard du positivisme, si l'on se rend bien compte du double aspect que présente ce système philosophique, lequel, tout en rejetant la doctrine catholique, professe une grande admiration pour son organisation administrative, qu'Auguste Comte aurait seulement voulu plus rigide et autoritaire. Ce dernier aspect a séduit un certain nombre de catholiques et leur a fait négliger, oublier le reste.

En effet, c'est avant tout une question de hiérarchie et d'organisation, beaucoup plus qu'une question de dogme, qui, vers 1830, préoccupait les meilleurs esprits d'Oxford, comme Hurrell Froude, J. H. Newman, Ward, Manning, etc. C'est le souci d'émanciper l'église anglicane de la sujétion de l'Etat et de l'investir de l'autorité et du prestige d'une église d'institution divine qui suscita la publication des " tracts ", et détermina ultérieurement la conversion au catholicisme de nombre des promoteurs de ce mouvement.[3] Ces

[1] *Les doctrines sociales catholiques en France*, t. I, p. 44-45.

[2] *Id.*, *ibid.*, t. II, p. 39-41.

[3] Newman, *Apologia pro vitâ suâ*, Londres, Routledge, p. 27, 28, 34, 35, 44, 46, 65, 115, 119, 164, 220; Introduction de W. Llewelyn Williams à l'*Histoire du règne de Henri VIII* par J. A. Froude, Londres, Dent, t. I., p. VIII; Justin McCarthy, *History of our own times*, New-York, Crowell, t. I., p. 159-167.

hommes qui avaient résolu de revendiquer l'autorité de leur parole et le caractère sacré de leur mission contre les assauts des libéraux et des évangélistes, d'une part, et contre ceux des philosophes allemands de l'autre, ne pouvaient se défendre d'une certaine sympathie pour le fondateur du positivisme, qui à travers bien des divagations, conspuait la métaphysique d'Outre-Rhin, se faisait l'apologiste de l'Eglise au moyen âge, et préconisait la séparation des deux pouvoirs, temporel et spirituel, en vue de mieux assurer l'indépendance de celui-ci.

On conçoit aussi qu'après avoir traversé pareille crise, ces anglicans passés au catholicisme fussent les tenants indéfectibles de l'autorité ecclésiastique. " Comment se fait-il, demande Harrison au cardinal Manning, que vous n'encouragiez pas le mouvement pour le " désétablissement " (la séparation) de l'église anglicane ? L'effet de cette séparation ne serait-il pas de vous attirer de nombreuses conversions ? "—" Je le sais bien, répondit le prélat, mais la libre-pensée, l'agnosticisme, le positivisme, en profiteraient encore plus que nous. Le principe de l'union de l'Eglise et de l'Etat est trop sacré pour que nous nous y attaquions ".[1]

Puis, nous l'avons vu, ce qui établit un lien entre le fondateur du positivisme et beaucoup des catholiques français, ce n'est pas une communauté de croyances, c'est uniquement une similitude de tendances en matière d'organisation. Que ce soit l'effet des circonstances particulières où ils se trouvent, ou celui de leur formation sociale traditionnelle, catholiques anglais et catholiques français affectionnent les solutions communautaires et autoritaires, et dès lors, ils trouvent dans les écrits de Comte beaucoup de principes à leur convenance.

Ainsi favorablement disposés envers Comte, les catholiques furent bientôt amenés, on le conçoit, à s'initier à sa sociologie. Ce n'est pas tout; pendant longtemps, de l'avis de beaucoup de catholiques, les questions sociales se confondaient absolument, ou à peu près, avec les questions de morale religieuse. Dès lors elles étaient tranchées d'autorité et il n'y avait pas lieu d'en faire l'objet d'une science distincte. Plus tard, lorsqu'ils sentirent davantage la nécessité de s'appliquer à l'étude particulière de ces questions, que d'autres creusaient avec zèle, c'est à titre de critiques qu'ils s'y adonnèrent, et de critiques, naturellement, de ceux qui leur paraissaient le plus osés dans leurs affirmations: les sociologues à la manière de Comte et de Spencer.

A lire et à réfuter les œuvres des sociologues, les polémistes catholiques en vinrent à adopter insensiblement la terminologie

[1] *Memoirs*, p. 90.

de l'école. Toutefois, pour avoir fait la chasse aux erreurs, et un peu aux idées, dans les écrits des sociologues comtistes et autres, pour leur avoir même emprunté certaines de leurs expressions, ces écrivains catholiques n'en ont pas pour cela adhéré aux théories ou aux méthodes de ces sociologues. Loin de là.

V

Les aventures de la sociologie (la chose).

En effet, si la sociologie a envahi le monde, c'est le mot beaucoup plus que la chose qui a remporté ce succès. En ce qui regarde la doctrine, et même abstraction faite du groupe catholique, dont le ralliement est hors de question, on ne saurait se figurer un conflit plus général et irréductible d'opinions et de systèmes que celui présenté par un congrès de sociologues authentiques, ou la série des intéressantes revues et analyses contenues dans la collection de l'*Année sociologique*, publiée sous la direction de M. Durkheim. Les spécialistes des diverses sciences auxiliaires (anthropo-géographie, anthropologie, ethnologie, démographie, économie politique, histoire des civilisations, histoire des religions, science juridique, etc.), luttent tous ardemment pour faire prévaloir leur discipline particulière. Ils sont encadrés, et plus ou moins dominés, par un état-major de fervents de la sociologie générale, simples philosophes, et extrêmement divisés entre eux: comtistes, matérialistes, biologistes, évolutionnistes, psychologues, rationalistes-naturistes, ou mécanistes, etc.

Entre sociologues contemporains il se manifeste des dissentiments profonds, persistants, il s'engage de vives polémiques sur des questions fondamentales. Au sujet, par exemple, du matérialisme historique de Marx et d'Engels (plus exactement, l'interprétation économique de l'histoire, ou simplement le déterminisme économique), on trouve rangés d'un côté l'Allemand Cunow, quatre sociologues italiens, Labriola, Groppali, Loria, Asturaro, et un sociologue américain, Patten, et de l'autre, l'Allemand Barth, tenant de la philosophie de l'histoire, ainsi que plusieurs rédacteurs de l'*Année sociologique*, Bouglé, Lapie, Durkheim et Parodi.[1] Le matérialisme proprement dit, cosmologique, moniste et mécaniste, y a pour interprètes Létourneau, De Greef, de Marinis, etc., et pour critiques Fauconnet, etc.[2]

[1] L'*Année sociologique*, t. I, p. 118 et suiv. 156-159; t. II, p. 315-318; t. III, p. 157-158, 189-190; t. IV, p. 110-112; t. V., p. 129-132.

[2] *Année soc.*, t. I, p. 278; t. V, p. 145-149; De Greef, *Précis de sociologie*, p. 11 et 64.

Le fameux procédé de l'analogie biologique, de l'organicisme, qui, s'inspirant de Comte et de Spencer, assimile la société à un être ou à un organisme vivant, est défendu par Novicow, Lilienfeld, Espinas, Worms, etc., battu en brèche par Létourneau, De Greef, Tarde, Seignobos, Bouglé, Durkheim. Létourneau, par exemple, qui, en matérialiste déterminé, trouve le fondement des " formes juridiques dans l'irritabilité de la cellule nerveuse ", qualifie de " si peu soutenable " la comparaison " entre les organismes sociaux et les organismes biologiques ".[1]

L'évolutionnisme de Spencer, qui trouve de nombreux adeptes dans le monde scientiste, s'étale, frotté de matérialisme, de mécanisme et d' " un positivisme un peu étroit et dogmatique " dans les ouvrages de Lester Ward, doyen des sociologues américains, qui, de ce fait, est raillé par un des principaux collaborateurs de l'*Année sociologique*, M. Parodi.[2]

La fameuse loi du passage progressif de l'homogène à l'hétérogène, que Spencer a empruntée au biologiste allemand Von Baër, et dont il a fait le fondement de toute sa philosophie synthétique (sociale et autre), est carrément rejetée par le plus répandu des psycho-sociologues français, Gabriel Tarde, qui soutient, au contraire, que la marche de l'humanité, de la société, va de l'hétérogène, état primitif, vers l'homogène, par le procédé de l'imitation. Et M. Worms, qui, en sa qualité de secrétaire de la société, se croit tenu de rétablir l'accord entre tant de doctrines contradictoires, fait de son mieux pour démontrer que cette opposition entre Spencer et Tarde n'est qu'apparente! Celui-ci, dans son livre *Les transformations du pouvoir*, n'en prétend pas moins que les seules lois que le sociologie puisse découvrir ce ne sont pas des lois d'évolution, mais des lois de "causation."[3]

Au reste, Tarde comme Spencer lui-même est rangé parmi les adeptes du "psychologisme"; et ils sont en nombre parmi les sociologues les plus en vue et les rédacteurs même de l'*Année sociologique*. Cependant, ils ont trouvé à qui parler. Notamment, M. Emile Durkheim, directeur de l'*Année sociologique* et professeur en Sorbonne, leur a fait une lutte très vive. A la loi de l'imitation universelle et spontanée que Tarde opposait à Spencer, M. Durkheim op-

[1] Létourneau; *La sociologie*, p. VIII; De Greef; *op. cit.*, p. 51; Seignobos: *La méthode historique appliquée aux sciences sociales*, p. 220 et suiv; *Année soc.* t. I., p. 126 et suiv, 135 et suiv., 278; t. II., p. 181; t. III, p. 159, 188; t. V.,p. 128.

[2] *Année soc.*, t. II, p. 167 et suiv.

[3] Worms, *Philosophie des sciences sociales*, t. III, p. 289-292; *Année soc.*, t. III, p. 357.

pose, mais sans pour cela se rallier à Spencer, "la contrainte", qui serait, suivant lui, le caractère distinctif du fait social.[1]

A la vérité, c'est en suivant la trace de M. Durkheim, ne serait-ce que durant une période relativement courte de sa carrière intellectuelle, que l'on a l'impression la plus vive de l'état de division et d'anarchie de la sociologie contemporaine. Ils sont nombreux et se recrutent dans tous les camps, les sociologues avec qui il a dû croiser le fer, soit à l'attaque, soit pour se défendre. Avec sa théorie juridico-sociale des groupements humains, même élémentaires comme la famille, il s'est trouvé de bonne heure aux prises à propos du totémisme, par exemple, avec les anthropologistes, ethnologues, folkloristes Morgan, Tylor, Kohler, Frazer, Starcke, Westermarck, Spencer et Gillen.[2]

Puis M. Durkheim ayant ainsi, au nom de la raison, revendiqué (et parfois victorieusement) les droits de la sociologie spécifique, contre les prétentions outrées des adeptes des sciences de la nature, se retourne et, toujours au nom de la raison, revendique les droits de la sociologie contre les tenants des sciences de l'esprit; il devient naturiste et objectiviste contre l'armée des psychologues. Or, dans cette attitude, il se montre tellement extrême qu'il se trouve en conflit avec celui qui est à ses yeux "le maître par excellence", avec Comte, comme aussi avec Mill et avec Spencer. Non seulement a-t-il maille à partir avec les psychologues outranciers comme Tarde et Seignobos, mais aussi avec la plupart des psycho-sociologues américains, pourtant beaucoup plus objectivistes, et aussi avec plusieurs de ses propres collaborateurs à la direction de l'*Année sociologique*. Même le sociologue allemand Simmel, qui dans la Revue de M. Durkheim se trouve classé, avec lui et quelques autres, parmi les protagonistes de la sociologie objective et spécifique, ne trouve pas grâce auprès de lui.[3]

Evidemment, les sociologues des deux mondes sont encore loin de réaliser cet accord indispensable à l'établissement du pouvoir spirituel rêvé par Auguste Comte. C'est que, en effet, leur sociologie

[1] Durkheim, *Les règles de la méthode sociologique*, p. 16 (note); *Tarde*, dans la collection des grands philosophes, p. 55 et suiv.

[2] *Année* soc., t. I., p. 306-318, t. V., p. 82-121. Voir aussi un article de M. Marcel Mauss, sur certains travaux de Tylor et Fraser, *Année soc.*, p. 217-220; et une critique de M. H. Hubert, des vues de M. V. de Lapouge relatives à l'indice céphalique, t. IV. p. 143-145 et 146; enfin, une notice sur un livre de l'anthropologiste Paul Topinard, même volume de l'*Année soc.*, p. 122.124.

[3] *Année soc.*, t. I, p. 123; t. II, p. 146, 167-168, 171-174 où Ward et Vincent sont critiqués par M. Parodi; t. III, p. 152, 183-184, où Ellwood est jugé un peu sévèrement par M. Durkheim; t. IV, p. 113, 154; t. V, p. 124-127, 134 où Small tombe à son tour sous la férule du même M. Durkheim, et p. 145; aussi, Durkheim, *Règles de la méthode sociologique*, p. 25, 26, 111, 134, 145; Bouglé, *Les sciences sociales en Allemagne*, p. 150 et suiv.

n'est pas constituée sur le modèle d'une science d'observation, et consiste plutôt dans une élaboration de principes philosophiques. Dès lors, elle est féconde en problèmes insolubles, et ses disputes, comme celle de la philosophie, sont éternelles.

Aucun des instaurateurs de la sociologie n'a réussi à la constituer scientifiquement, à en faire effectivement "la science sociale". Auguste Comte, de l'avis même de Stuart Mill, alors son plus fervent admirateur, ne saurait être considéré comme le créateur de la sociologie. C'est la dynamique sociale seulement qu'il aurait mise sur pied par la découverte et la mise en œuvre de sa fameuse loi des trois états. Tel est son principal titre de gloire.[1] Or l'inanité de cette loi fondamentale a été catégoriquement établie par Spencer au point de vue philosophique, et par M. Durkheim lui-même, au point de vue sociologique et historique.[2] Le philosophe américain Fiske qui un moment a été comtiste, avant de se rattacher à l'école de Spencer, et qui a toujours conservé un sentiment admiratif pour Comte, qui l'a défendu à l'occasion contre Spencer même, n'en est pas moins amené à reconnaître que le fondateur du positivisme n'a pas créé une science de la sociologie.[3]

Frederic Harrison qui, lui, est resté fidèle à Comte jusqu'à la fin, et défend les idées de son maître vénéré toutes les fois qu'il reste un semblant de raison à invoquer, reconnaît que Comte n'a pas "constitué" la science de la société, il l'aurait simplement "institué". Son ambition, nous assure M. Harrison, n'allait pas plus loin, et il se console presque de cette lacune dans l'œuvre de Comte en constatant que ses continuateurs n'ont pas depuis grossi notablement le bagage de la sociologie.[4]

Enfin, M. Lévy-Bruhl, qui passe pour être avec M. Durkheim "le continuateur direct et le rénovateur du positivisme"[5] constate que "la sociologie de Comte reste avant tout une philosophie de l'histoire".[6]

Mill, tout enthousiaste qu'il était de la dynamique sociale et de la loi des trois états inventées par Comte, jugeait qu'il y avait lieu d'y adjoindre une discipline complémentaire: l'éthologie, sorte de psychologie sociale. Il aurait voulu être lui-même l'instaurateur de cette nouvelle science; mais sa tentative ne put jamais aboutir,

[1] Mill, *Comte and Positivism*, p. 119-121, 124, aussi son *Autobiography*, p. 212.

[2] Fiske, *Cosmic Philosophy*, p. 173-174; Durkheim, *Règles de la méthode sociologique*, p. 25-26, 96.

[3] *Op. cit.*, t. II, p. 233.

[4] Harrison, *The philosophy of common sense* p. 342-343.

[5] Abel Rey, *La philosophie moderne*, p. 30.

[6] *Année soc.*, t. IV., p. 151.

et c'est de désespoir et comme pis-aller qu'il rédigea son traité d'économie politique.[1]

Quant à Littré, du traité de sociologie qu'il présenta à la Société sociologique solennellement inaugurée par lui en 1872, le P. Gruber dit que "ce n'est qu'une insipide nomenclature de termes barbares dérivés fort arbitrairement du grec et du latin." En voici des exemples: Sociodynamie (dynamique sociale); sociomérie (statique sociale); sociergie (conservation de la société); sociauxie (accroissement de la société); socioporie (économie nationale); sociagathie (morale); sociocalie (lettres et arts); socialéthie (sciences); sociarchie (législation, droit).[2] Mais aucun de ces mots n'a eu un succès comparable à celui de "sociologie". Sans doute, il serait injuste de voir dans cette contribution linguistique du grand lexicographe la mesure de son mérite en tant que sociologue. Mais il ne paraît pas en tout cas avoir fourni à la science nouvelle de principe véritablement organique, et même son nom ne revient que très rarement dans les écrits ou les discussions des sociologues modernes.

L'œuvre sociologique de Spencer est assurément imposante par la masse et l'ordonnance. Mais si l'on fait exception de la partie purement ethnologique de ses travaux, que reste-t-il de lui de fondamental ? Son procédé de l'analogie biologique a, de l'aveu de tous sociologues sérieux, fait son temps; et sa prétendue loi du passage de l'homogène à l'hétérogène, aussi très contestée, est en tout cas trop générale pour être réellement utile.

Et que dirons-nous de l'œuvre des sociologues contemporains ? Somme toute, elle n'est pas jusqu'ici très hautement appréciée dans le monde savant, et le peu de cas qu'on en fait se manifeste parfois au moment où on s'y attend le moins. Par exemple, M. Abel Rey, aux yeux de qui Durkheim est le sociologue sans pareil, a cependant une opinion assez peu flatteuse des productions de la sociologie courante. "La sociologie, écrit-il, vers la fin de son livre sur la philosophie moderne, la sociologie, grâce aux travaux de Durkheim et de son école, a travaillé et fait." Voilà qui va bien. Mais pourquoi ajoute-t-il un peu plus loin parlant des "premières réalisations" de la sociologie, qu'il ne faut pas "exagérer leur importance. C'est très peu de chose" ?[3]

Montrons-nous plus généreux que M. Rey: Dans les écrits des sociologues modernes les plus en vue, il se trouve beaucoup de choses bien comprises et bien dites, des dissertations et des critiques d'un intérêt très réel, un foisonnement d'aperçus ingénieux, même des

[1] Mill, *Logic*, p. 626; Bain: *John Stuart Mill, A criticism* etc., p. 79.

[2] Gruber, *Le positivisme*, p. 27-28.

[3] *La philosophie moderne*, Paris, Alcan 1908, p. 314-315.

investigations bien conduites et poussées à fond. Mais trop souvent cela est vicié par l'insuffisance d'une méthode qui est philosophique, au lieu d'être scientifique. Le mot, intentionnel ou non, de M. Picard, au sujet d'Auguste Comte, "qui se préoccupait surtout de sociologie" et (sans transition) "n'était pas un savant"[2], pourrait s'appliquer sans injustice à beaucoup de ces éminents sociologues qui ne veulent pas de "science sociale", mais simplement une "sociologie" abstraite, superposée à *des* sciences sociales, c'est-à-dire un ensemble de spécialités scientifiques surbordonnées ou accolées à une simple discipline philosophique.

Dans ces conditions, les sociologues, tout en prétendant fonder leurs conclusions sur l'observation des faits, doivent se contenter de renseignements de seconde main, recueillis au petit bonheur, par des spécialistes plus ou moins compétents en matière sociologique. Ils oublient, ou négligent, lorsqu'ils ne méprisent pas de parti pris, les deux procédés inséparables de toute science sérieuse: l'observation monographique de l'objet essentiel de la science et la nomenclature des faits ou concepts propres à cette science. Dans tous les trésors de la sociologie proprement dite, il ne se trouve rien de comparable à cette double découverte due aux deux instaurateurs de la Science sociale: la monographie de groupement, inaugurée par Frédéric LePlay, et la nomenclature des faits sociaux due à Henri de Tourville. Tous le reconnaîtront un jour.

VI.

L'emploi abusif et l'emploi légitime de "sociologie".

Nous sommes maintenant en mesure de tirer certaines conclusions utiles de cet historique de la sociologie. Tout d'abord, il ne saurait être question d'éliminer le vocable même. Le fait accompli s'impose. Le mot est entré dans la langue de la classe instruite en tous pays civilisés. Même s'il était possible d'enrayer une pratique aussi générale dans toutes les langues savantes, il serait assurément inopportun de tenter l'entreprise.

Le mot mérite de vivre, ne serait-ce qu'à raison de la commodité de son emploi. C'est l'argument principal avancé par Comte, par Mill, par Spencer; et en ces matières, les considérations d'ordre pratique ont le pas sur celles d'ordre théorique. "Sociologie" a sur "science sociale" l'avantage de la brièveté; un seul mot fait l'office de deux. "Sociologie" donne l'adjectif "sociologique", qui n'a pas les mêmes emplois que "social" et en est l'indispensable complément. Dans l'usage courant, déjà "sociologie" donne l'impression d'un

champ d'étude un peu plus circonscrit que "science sociale", et indique dès lors l'état d'une science mieux définie, plus précise et méthodique.

La futilité de certaines objections faites à l'emploi de "sociologie" ou de "sociologique" saute aux yeux. Les puristes ont souvent signalé la composition mixte, bâtarde, de ce terme, emprunté pour partie au latin et pour partie au grec. Mais cette objection des puristes n'est guère prise au sérieux; Spencer, entre autres, s'en moque, et avec raison. Même, là où les puristes voient une tare, d'autres voient une supériorité. C'est ainsi que M. Frank Granger, professeur à University college, Nottingham (Angleterre), se fondant sur l'autorité de Comte même, déclare admirable la structure de ce terme à la confection duquel a contribué la langue de chacun des deux grands peuples éducateurs de l'antiquité.[1]

Plus sérieuse, l'objection fondée sur les origines et les attaches positivistes du mot, ne saurait cependant nous retenir bien longtemps. Par suite de son extraordinaire diffusion, de son emploi constant par des penseurs et spécialistes, même, se rattachant à des écoles diamétralement opposées d'esprit et de tendances, le terme paraît avoir perdu toute trace d'hérédité positiviste, quoique les adeptes ou fidèles du maître ne laissent guère passer une occasion de rappeler les titres de Comte à sa paternité. Il suffira que ceux dont l'admiration est moins entière restent en méfiance de l'esprit sectaire de quelques-uns de ses continuateurs, comme aussi des procédés méthodologiques de la plupart des sociologues Comtistes, évolutionnistes, psychologues, etc.

Mais, s'il n'est ni possible ni opportun d'ostraciser le terme " sociologie ", il est possible, et plus que jamais nécessaire d'en régulariser l'emploi, du moins en ce qui regarde les fervents de la science. Puisqu'il nous faut compter désormais avec le mot " sociologie ", et puisque, d'un autre côté, l'ancien vocable de " science sociale " n'est pas près de tomber en désuétude, il importe de bien définir les limites de l'emploi propre de chacun de ces termes. Précisément, dans un ouvrage récent dû à la plume d'un sociologue distingué des Etats-Unis, je trouve les matériaux d'une discussion et d'une solution pratique de cette difficulté.[2]

M. Ellwood passe en revue un grand nombre de définitions ayant cours en divers milieux. Il les répartit en six catégories. Mais elles donnent une vue plus simple et claire de la question, une

[1] Durkheim, *De la méthode*, p. 307, note; F. Granger, *Historical sociology*, Methuen, 1911, p. 1.

[2] *Sociology in its psychological aspects*, by Charles A. Ellwood, professor of sociology in the University of Missouri, New-York, Appleton, 1912, p. 2-8.

fois ramenées à trois. La première division comprend les définitions d'ordre populaire ou pratique, qui, confondant la science et l'art, voient dans la sociologie l'investigation méthodique des moyens, l'adoption des mesures à prendre en vue de réformer la société, de corriger les abus, de réprimer le vice, etc. Il est curieux de constater que le terme de " science sociale " avait déjà subi une déformation correspondante, surtout dans les pays de langue anglaise, et qu'en Angleterre, comme aux Etats-Unis, les " Social science associations ", dont la première remonte à 1857 avec lord Brougham comme président à Londres, s'occupaient uniquement, à l'instar des Sociétés de bienfaisance établies en France au dix-huitième siècle, de questions et de mesures d'hygiène publique, d'éducation, de jurisprudence, d'économie sociale, et autres de même nature. C'est une bonne illustration de ce trait de formation sociale signalé par Comte dans une de ses lettres à Mill, où il lui parle de " l'exorbitante prépondérance des sentiments pratiques dans le milieu anglais ".[1]

En second lieu, nous avons une classe de définitions émanant d'hommes de science, adeptes parfois de ce qu'on appelle sciences sociales particulières, mais qui ne sont pas à proprement parler des sociologues. Pour eux, la sociologie est simplement " la science des phénomènes sociaux ". Cette définition n'est guère acceptable, comme le remarque fort bien M. Ellwood, n'étant ni assez précise ni assez spécifique. Si la sociologie est la " science des phénomènes sociaux ", alors il n'y a plus d'emploi pour l'ethnologie, pour l'économie politique et nombre d'autres sciences qui traitent d'une classe particulière de phénomènes sociaux, sans cependant se confondre avec la sociologie. Plutôt que d'abdiquer leur droit à l'existence, les fervents de chacune de ces sciences sociales particulières, chercheraient sans doute, à s'accaparer tout le domaine de la sociologie.

D'autre part, si les auteurs de cette définition entendent par là faire de " sociologie " le terme général embrassant toutes les disciplines sociales, ils oublient qu'il existe déjà un vocable très usité et qui est le seul propre dans l'espèce: celui même de " science sociale." Et ici, qu'on me permette de citer le propre texte de M. Ellwood, que je ne connaissais nullement, et dont le livre n'était pas même sorti des presses, lors de notre discussion à la Société Royale; on se rendra compte à quel point ce texte corrobore l'opinion que j'exprimai dans cette circonstance:

Social science is preferable to " Sociology " as an encyclopedic term for all the social disciplines, and is now so used by the best authorities.[2]

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[1] *Lettres*, p. 441.

[2] *Op. cit.*, p. 4, (note).

Je n'avais donc pas tout à fait tort de m'opposer au choix de " Sociologie " comme substitut de " science sociale " dans la rubrique descriptive de notre section. Le mot de " science sociale " doit être retenu pour désigner l'ensemble des études relatives à la société, et le mot " sociologie ", réservé pour cette partie de la science sociale qui a trait à l'investigation méthodique des conditions et lois d'existence des groupements humains. Si j'en juge par ce qui se passe dans notre propre Ecole de la science sociale, c'est sur cette base que se fera la délimitation du domaine linguistique de chacun de ces vocables. Et, dès lors, pourquoi, entre les diverses sciences sociales particulières, inscririons-nous la sociologie à l'exclusion de presque toutes les autres ?

Les autres définitions examinées par M. Ellwood, et qu'il considère en quatre paragraphes, peuvent toutes se ranger sous cette rubrique: la sociologie, science des groupements humains. Approximation suffisante, pourvu qu'on entende bien ces termes. Aussi bien, il s'en trouve parmi ces dernières définitions qui sont vagues, imprécises. Telles sont les deux définitions de M. Giddings: " La sociologie, étude scientifique d'un groupe ou nombre quelconque de personnes en relations les unes avec les autres et tendant vers une certaine conformité de vues ".[1] Ou encore, cette autre: " La sociologie, essai d'explication de l'origine, de la structure et de l'activité des sociétés par le jeu d'agents physiques, biologiques et psychiques, en état de combinaison et d'évolution ".[2] Telle est encore cette définition de M. Small: " La sociologie, science du processus social ".[3]

Puis, nous avons la définition trop concrète attribuée à Ward, à Powell, à Spencer même, laquelle fait de la sociologie la "science des institutions", terme dont la signification ordinaire est trop étroite pour embrasser toutes les sortes de groupements, et qui, dans le sens étendu où certains auteurs le prennent, de toute pratique ou coutume sanctionnée par la loi ou par la tradition, cesse d'être spécifique.[4]

D'autre part, la définition du sociologue allemand Simmel est trop abstraite, puisqu'elle réduit la sociologie à l'étude des formes ou modalités des groupements, de telle sorte que ce ne serait plus qu'une géométrie sociale.[5]

Il reste deux définitions de la sociologie, l'une de M. Ellwood même, pour qui la sociologie est "la science de l'organisation et de l'évolution de la société", formule, comme il le constate, qui reproduit à

[1] *Id.*, *ibid.*, p. 4 (note).
[2] *Id.*, *ibid.*, p. 8 (note).
[3] *Id.*, *ibid.*, p. 8 (note).
[4] *Id.*, *ibid.*, p. 5.
[5] *Id.*, *ibid.*, p. 6.

peu près l'idée que s'en faisait Auguste Comte; et celle du biologiste écossais M. J. Arthur Thompson, que M. Ellwood paraît préférer même à la sienne: "La sociologie, science de l'origine, du développement, de la structure et des fonctions des formes de l'association".[1]

Certes, ces dernières définitions, surtout si on les entend bien, sont très acceptables. Mais aucune ne me paraît, pour la rigueur et la clarté, valoir celle qu'Henri de Tourville donnait de la science sociale, dès 1886: "La science sociale a pour objet les conditions ou les lois qu'exigent entre les hommes la plupart des manifestations de leur activité".[2] Et l'on pourrait prendre pour formule abrégée: la sociologie, science des groupements humains. Car il va de soi pour tout spécialiste tant soit peu logicien qu'on ne saurait se dispenser d'analyser ce qui fait l'objet propre de sa science, d'en étudier la composition, le fonctionnement, les moyens, le mode et les phases d'existence.

Il est un point sur lequel M. Ellwood ne paraît pas s'être exprimé avec suffisamment de netteté. En plus d'un endroit il parle bien comme si la sociologie était à son gré une science sociale particulière (notamment aux pages 3 et 4); et il se montre soucieux de lui conserver son autonomie tout autant que de respecter celle des autres sciences. Cependant, d'autres passages sont moins fermes d'allure, et vers la fin de sa dissertation, il accepte presque au même titre que ses définitions préférées celle de Schaëffle, pour qui (et il n'est pas le seul) la sociologie est " une philosophie des sciences sociales."[3] Or, il faut choisir entre les deux. Il serait exorbitant que la sociologie fût à la fois science sociale particulière et philosophie de l'ensemble des sciences sociales. Et il n'est pas du tout indifférent qu'elle soit l'une ou l'autre. Si l'on adopte cette dernière solution, si on en fait simplement une philosophie, elle restera en proie à la dialectique, un champ d'interminables discussions, intéressantes, amusantes peut-être, mais plus ou moins oiseuses. Si, au contraire, on en fait une science d'observation monographique et (autant que possible) directe, confinée dans le domaine du vérifiable, sans mépriser, sans exclure pour cela de la pensée et de la vie la métaphysique, qui n'est pas vérifiable par les procédés ordinaires de la science, sans non plus négliger de tenir compte des découvertes, des constatations vérifiées des autres sciences, la sociologie, devenue la science sociale (seulement, avec un sens un peu plus circonscrit) trouvera des solutions qui s'imposent, elle rendra des services, elle sera respectée.

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[1] *Id.*, *ibid.*, p. 7 et 8.

[2] La revue *la Science sociale*, t. I, p. 30.

[3] *Id.*, *ibid.*, p. 8 (note).

On me permettra peut-être de signaler en terminant l'avance sérieuse réalisée à cet égard par l'Ecole de la science sociale fondée par LePlay, de Tourville et Demolins, et aujourd'hui placée sous la géniale direction de M. Paul de Rousiers. Depuis trente ans, cette école met en œuvre, avec un remarquable succès, le procédé de l'observation monographique, à la lumière de cette admirable nomenclature sociale d'Henri de Tourville. Et depuis près de trente ans, sauf les intermittences imposées par les nécessités du "struggle for life", il m'a été donné d'utiliser à la fois ce procédé de la monographie sociale et cet instrument de précision qu'est la nomenclature d'Henri de Tourville: j'ai pu à loisir me rendre compte des inestimables avantages assurés par l'emploi de l'un et de l'autre. C'est même le vif sentiment de l'utilité et de l'excellence de cette nomenclature, des services qu'elle a déjà rendus et de ceux encore plus grands qu'elle est appelée à rendre à l'avenir, qui m'a engagé, il y a deux ou trois ans, à soumettre aux chefs de l'Ecole à Paris l'idée de certaines modifications à y faire, de manière à la rendre plus maniable et à la mettre tout à fait au courant de l'état actuel de la science.

Ces modifications consisteraient, en premier lieu, à hiérarchiser en quelque sorte les concepts ou faits inscrits dans la nomenclature d'H. de Tourville, de manière à mettre pleinement en évidence le phénomène social central, qui est le groupement humain. Puis, on dédoublerait toute cette nomenclature, pour en tirer, en même temps qu'un recueil des faits ou concepts organiques de la science sociale, une classification, au moins préliminaire, des groupements.

Cette proposition, même sous la forme très imparfaite où elle leur avait été soumise, fut l'objet d'un accueil sympathique de la part de plusieurs de mes collègues les plus expérimentés. Même quelques-uns, dont l'autorité en ces matières est beaucoup plus grande que la mienne, et entre tous, un de nos Anciens les plus respectés et les plus écoutés, M. Philippe Champault, ont bien voulu m'assurer de leur cordial appui, en vue de la bonne exécution d'un tel projet.[1]

[1] Au moment où l'imprimeur me réclame mon manuscrit (21 janvier 1915), une lettre de France m'annonce la mort de M. Champault, survenue il y a exactement un mois. C'est une perte douloureuse pour sa famille distinguée, pour Châtillon-sur-Loire, dont il fut de longues années le premier magistrat, comme aussi pour les études, surtout pour notre Ecole de la science sociale, dont il fut un des membres les plus industrieux et les plus utiles. J'y suis tout particulièrement sensible, à raison de l'amitié très vive qu'il me témoigna ces années dernières et de sa collaboration effective dont j'ai eu le bénéfice. Déjà avantageusement connu par des recherches sur l'antiquité grecque et d'autres nombreuses études sociologiques, M. Champault, il y a deux ans, communiquait à la Société Royale des documents inédits et d'un haut intérêt sur des membres de sa famille, et entre autres François Gendron, chirurgien attaché à la compagnie de Jésus aux débuts de la

Sans doute, il y faudra l'effort collectif des adeptes les plus compétents d'ici quelques années; mais, une fois ce progrès accompli, l'Ecole de la science sociale se trouvera singulièrement bien outillée en vue de l'exploitation de son domaine scientifique, et c'est plus que jamais sur son modèle que devra se constituer la sociologie de toute origine et de toute venue, si elle veut vivre et progresser, si elle veut être plus qu'un mot, plus qu'une théorie, si elle veut figurer dignement parmi les sciences, non pas positivistes, mais positives ou tendant à le devenir.

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colonisation de la Nouvelle-France. Ce sera, disait-il, un nouveau lien entre le Canada et son ancienne mère patrie.

Deux oubliés de l'Histoire: Jean-Baptiste Bruce.—Jean-Louis Légaré.

Par L'HONORABLE JUGE L.-A. PRUD'HOMME.

(Lu le 27 mai, 1914.)

I. Jean-Baptiste Bruce.

Voyage dans les régions polaires.—A la recherche de Franklin.

Celui qui fait l'objet de cette note biographique était un modeste cultivateur de Saint-Boniface. Il avait passé une partie de son existence à voyager dans le Nord-ouest, au service de la Compagnie de la Baie d'Hudson. Il faisait partie de l'arrière-garde des vétérans du pays, que la mort décime tous les jours.

Il est bon, avant qu'ils soient oubliés, de consigner les récits des voyages extraordinaires accomplis par ces hommes intrépides.

On sait que nos compatriotes figurent avec honneur dans presque toutes les expéditions qui ont été tentées dans ces vastes plaines. Tout redit, dans cette partie du continent, leur courage héroïque et leur esprit aventureux.

Bruce, quoique simple guide, s'est distingué plus d'une fois. Il s'est avancé dans le nord, aussi loin qu'il est possible de le faire, en voyageant par terre; et, de l'aveu de tous, ce n'est que grâce à son habileté et à ses connaissances du pays que ses compagnons purent échapper à une mort certaine.

On sait qu'il y a quelques années des efforts furent tentés en Angleterre, pour sauver d'abord, s'il en était encore temps, Franklin et son équipage, et ensuite, lorsque tout espoir fut perdu, pour retrouver ses restes.

Bruce prit part à l'un de ces voyages qui, malheureusement, demeura aussi infructueux que les précédents.

C'est de cette expédition fue je désire parler tout particulièrement; mais avant d'entrer en matière, l'on me permettra bien de dire quelques mots de celui qui la dirigea à travers des régions inconnues.

Jean-Baptiste Bruce naquit le 15 septembre 1807 à l'Ile-à-la-Crosse. Son père, Pierre Bruce, venait de Sorel (P.Q.) et arriva bien jeune dans ce pays.

Il paraitrait que, dans cette famille, on avait le goût des découvertes et des voyages d'aventure.

Pierre Bruce eut pour beaux-frères le célèbre Sir Alexandre Mackenzie et le Dr McLaughlin qui, pendant plusieurs années, fut gouverneur du fort Vancouver.

Jean-Baptiste fut baptisé par Monseigneur Provencher à Saint-Boniface, et retourna peu de temps après à l'Ile-à-la-Crosse où s'écoula son enfance.

A dix-sept ans, il se mit au service de la Compagnie de la Baie d'Hudson dont son père était un des principaux officiers.

Les salaires n'étaient pas élevés à cette époque; mais, comme tout est relatif dans la vie, avec une vingtaine de louis par année, un employé de la Compagnie se trouvait fort heureux.

Jean-Baptiste ne reçut que dix-sept louis pour la première année et vingt pour la seconde. C'était plus que suffisant pour lui permettre de se marier. C'est ce qu'il fit à l'âge de 28 ans. Après avoir servi pendant quelques années comme guide pour le transport des marchandises et des pelleteries entre l'Ile-à-la-Crosse et le fort York, il retourna à Saint-Boniface.

Il travailla à la construction de la cathédrale que les flammes détruisirent au mois de décembre 1860. La vie paisible que l'on menait à Fort-Garry seyait mal à sa nature débordante d'activité; aussi choisit-il la première occasion qui lui fut offerte pour s'élancer vers le nord.

Il partit avec Thomas Simpson et George Sinclair pour l'océan Arctique, dans un but d'exploration.

Ils se mirent en route assez tard, dans l'automne, et arrivèrent au lac Athabasca le 28 février, après avoir fait tout le voyage en raquettes. Ils retournèrent à la Rivière-Rouge, au printemps, après une expédition longue et pénible.

L'année suivante Bruce se rendit au fort Good Hope et, de là, il prit la direction de la Rivière-aux-Courants, au pied des Montagnes-Rocheuses. Pendant ce dernier voyage, il faillit être victime de son courage et de son dévouement.

Il fut obligé de parcourir plus de deux cents milles sans autre provision que ce que pouvait lui rapporter la chasse ou la pêche.

A son retour, la compagnie l'envoya au fort Francis.

Il était là depuis près d'un an, lorsqu'on lui proposa de faire partie de l'expédition de Richardson et Rae. Il accepta sur-le-champ et se rendit au Portage-la-Loche où il rencontra ces deux voyageurs.

Richardson, qui avait pris des renseignements sur Bruce, le choisit pour guide. L'expédition se composait de trente et une personnes, dont cinq Canadiens-français, cinq Muskégous, deux marins anglais, un charpentier, un traiteur et les deux chefs Richardson et Rae. Parmi les Canadiens se trouvaient Louis Laronde, Dubreuil et

Chartier. Ils contruisirent d'abord une barge et en appareillèrent quatre autres, dont le bois avait été préparé en Angleterre. Après avoir chargé les bateaux de poudre, plomb, pemmican et autres effets pour la traite, ils partirent le premier juillet 1850. Bruce, comme premier guide, signa un engagement d'un an avec un salaire de cinquante louis. Après avoir traversé le lac Athabasca et le grand lac des Esclaves, ils entrèrent dans la rivière Mackenzie qu'ils descendirent jusqu'à la rivière du lac du Grand-Ours.

A cet endroit, l'expédition se divisa en deux parties. Un groupe de treize voyageurs se rendit au lac du Grand-Ours, avec mission d'y construire un fort à l'entrée de la rivière Dease, afin de s'assurer un lieu d'hivernement.

Ce fort se nomme aujourd'hui " Fort Confidence ".

Plusieurs années avant, le capitaine Dease y avait élevé une bâtisse pour faire la traite. Ce poste avait été abandonné plus tard et personne n'avait songé depuis à le relever.

Les quinze autres voyageurs, guidés par Bruce, continuèrent à descendre le fleuve Mackenzie.

Sir Alexandre Mckenzie, parle, dans le récit de ses découvertes de la rivière qui porte son nom, de couches de lignite enflammées, dont on apercevait la fumée sur les rives. Nos voyageurs n'aperçurent rien de semblable. Ils remarquèrent çà et là des groupes d'Esquimaux et des troupeaux de bœufs musqués.

Le 20 août, ils s'arrêtèrent en face du fort Peel, qui n'était gardé que par deux employés de la Compagnie; un Canadien du nom de Manuel et un Anglais du nom de Taylor.

Ces deux personnes, qui n'avaient point vu de blancs depuis un an, furent transportées de joie à la vue de leurs compatriotees.

Ils les régalèrent de force poisson et caribou.

Ils aperçurent là les pelleteries les plus précieuses que l'on puisse imaginer. On comprend facilement que le froid excessif de cette contrée exerce une grande influence sur la qualité des fourrures.

Plus on se dirige vers le nord et plus le poil est fin, soyeux et fourni.

Manuel leur montra surtout des peaux de renard argenté et de loutre, noires scomme l'ébène. Ils achetaient ces pelleteries des Plats-Cotés-de-Chien. Les Esquimaux étaient, à cette époque, en guerre avec les Loucheux. Ces derniers surtout étaient hostiles aux blancs, parce que, prétendaient-ils, ils fournissaient des armes à leurs ennemis. Manuel et Taylor avertirent Richardson de se tenir sur ses gardes. Ces bons conseils ne manquèrent pas d'être utiles. Parvenus à la baie du Mackenzie, ils la trouvèrent remplie

de glaces et furent contraints d'attendre deux jours avant de pouvoir prendre la mer.

Le matin du départ, comme ils côtoyaient le rivage, ils aperçurent un certain nombre d'Esquimaux qui trempaient leurs arcs dans l'eau afin de les rendre plus souples.

Sur les avis de Bruce, les rameurs poussèrent les barges en toute hâte vers le large. Bien leur en prit, car ils entendirent aussitôt ces sauvages pousser des hurlements féroces, désappointés qu'ils étaient de ne pouvoir atteindre personne de leurs flèches.

Nos voyageurs passèrent du côté sud de l'ile Richards, voguant jour et nuit, au milieu d'énormes glaçons que le vent poussait avec fureur contre leurs frèles embarcations. Plus d'une fois, ils se trouvèrent saisis entre les glaces et obligés de faire portage pour atteindre une clairière et reprendre la mer.

Après avoir ainsi navigué, au milieu de mille dangers, ils arrivèrent à la Baie Liverpool, dans laquelle ils abandonnèrent une de leurs barges brisée par les glaces et réparèrent les autres du mieux qu'ils purent.

Richardson, quoique sur l'âge, supportait avec courage les misères et les privations du voyage.

Ils continuèrent à naviguer péniblement, pendant deux semaines, tantôt se traînant sur les banquises de glace, tantôt jetés au large et parfois poussés vers les brisants du rivage, courant d'écueil en écueil et souvent tombant de Charybde en Scylla. Enfin, après avoir failli périr nombre de fois, ils atteignirent la rivière Hopper, où ils entrèrent. Il en était temps, car les embarcations faisaient eau de toutes parts et n'étaient plus en état de tenir la mer.

Ils avaient été un mois en mer. L'équipage était épuisé de fatigue et la plupart des matelots, peu habitués aux froids intenses de ces contrées, avaient tellement souffert qu'ils n'étaient plus en état de faire le service. C'eût été folie de songer à pousser plus loin.

D'ailleurs, les vivres commençaient à manquer et la saison elle-même était fort avancée. Il fallait donc penser au retour. Ce n'était pas chose facile. Comment s'aventurer dans un pays stérile et sauvage, et qui n'était habité que par les Esquimaux aux époques de chasse et de pêche.

Jetés, sans secours, sur cette côte inhospitalière, la mort se présentait à eux sous ses aspects les plus sombres et les plus désolants.

On tint conseil. Il fut décidé que Rae partirait avec Bruce et trois des plus résolus et des plus vigoureux, à la recherche de la rivière du Cuivre. C'est ainsi qu'après avoir erré, pendant un mois,

sur des rives glacées, pour découvrir quelques vestiges d'un navigateur distingué, l'expédition en était réduite à chercher un port de salut pour elle-même. Richardson, qui était âgé et malade, fit élever une cabane, avec les débris de ses bateaux, et se décida à attendre, avec le reste de l'équipage, des nouvelles de Rae.

Ce dernier, après avoir pris le degré de latitude et autres observations astronomiques, partit avec quelques provisions et ses quatre compagnons. Ils marchèrent huit jours durant.

Pendant le trajet ils rencontrèrent un nombre considérable de cariboux, dont la viande, quoique un peu dure, servit à les régaler. Ces animaux s'approchent du voisinage de la mer, durant l'été, afin de se soustraire aux piqûres des maringouins et moustiques qui les tourmentent continuellement dans l'intérieur des terres. A l'approche des froids, ils s'enfoncent de nouveau dans l'intérieur. Le bois était tellement rare à certains endroits que Bruce et ses compagnons étaient réduits à lier des joncs en faisceau en guise de combustible. Par ce moyen ils réussissaient à rôtir un peu la surface de la chair du caribou.

Le neuvième jour après leur départ, Rae, se découvrant tout à coup, se mit à crier à ses compagnons: "Hourrah! voilà la rivière du Cuivre." Rae n'avait raison qu'à demi, car ce n'était que la baie dans laquelle se jetait cette rivière qu'il venait de reconnaître.

Ils ne parvinrent à la rivière que le lendemain. Ils la remontèrent jusqu'à la chute du Sang. Ils furent émerveillés de rencontrer, à cet endroit, un camp d'Esquimaux qui faisaient la pêche au saumon. Ils étaient une quarantaine en tout et paraissaient avoir fait la pêche de saint Pierre, tant leurs embarcations étaient remplies. Ils dardaient le poisson avec des bâtons dont le bout était armé d'un morceau de cuivre aigu.

Ce métal se trouvait en quantité considérable et presque pur sur les roches qui bordent cette rivière.

Les Esquimaux le ramassaient et le frappaient entre deux cailloux pour souder entre elles les diverses parcelles de cuivre. Une fois qu'ils avaient réussi à en former une masse solide, ils lui donnaient, toujours par les mêmes procédés rudimentaires, la forme qu'ils désiraient. Bruce conserva jusqu'à sa mort une coupe et une tasse fabriquées par les Esquimaux et qui lui furent données sur cette rivière.

Ils furent assez bien accueillis par les Esquimaux, dont plusieurs avaient fait la traite aux forts de la Compagnie de la Baie d'Hudson. L'un d'eux s'approcha d'un matelot qui, assis sur le bord de la rivière, regardait les pêcheurs en fumant nonchalamment sa pipe. Sans plus de cérémonie, il lui enleva sa pipe de la bouche, et lui demanda d'un ton insolent de lui donner du tabac. Rae se hata de lui en offrir

un morceau. Il eut bientôt lieu de s'en repentir, car ces sauvages ne furent satisfaits qu'après avoir enlevé aux blancs tout le tabac qu'ils possédaient. Ce fut une nouvelle privation qui vint s'ajouter à bien d'autres.

Le poisson était en telle abondance qu'il suffisait de regarder un instant le fond de la rivière pour en apercevoir des centaines qui prenaient leurs ébats en tous sens.

Rae, Bruce et leurs compagnons firent un repas succulent et ils en avaient besoin. Le lendemain ils repartirent pour aller retrouver Richardson. Ils avaient précédemment suivi le littoral de la mer; cette fois, ils se dirigèrent en droite ligne à travers les terres. Le voyage dura trois jours. On s'imaginerait difficilement la joie de Richardson en les apercevant. Maintenant qu'ils avaient reconnu la direction de la rivière du Cuivre, à l'aide des cartes, ils purent s'assurer de celle du lac de l'Ours. Ils décidèrent donc de se rendre à ce lac où un fort avait dû être construit l'automne précédent par leurs treize compagnons, dont ils s'étaient séparés à la rivière de l'Ours.

On commença par jeter à la mer les haches et autres instruments dont on pouvait se passer, de peur que les Esquimaux n'en fissent usage contre les blancs. Chaque homme devait porter son fusil pour se défendre, une couverte de laine pour s'abriter la nuit et 40 livres de pemmican. C'était un poids bien respectable pour entreprendre un voyage dont on ignorait le terme. Richardson, qui était obèse, suivait avec peine le reste de l'expédition. Bruce lui offrit de porter son fusil. Il accepta avec reconnaissance et plus tard lui en fit présent.

Richardson mit dans une boîte de ferblanc un grand nombre de lettres, *fac simile* de celles écrites par Franklin. Il fut obligé de l'abandonner avec bon nombre d'intruments astronomiques et autres effets.

Plus tard, sans doute, les Esquimaux, dans leurs courses vagabondes, ont dû retrouver ces articles; et, un jour, ces lettres et autres objets tomberont peut-être entre les mains des blancs. Nous ne serions pas surpris alors d'entendre dire que des documents de Franklin et des instruments qui lui servaient dans son expédition, ont été retrouvés sur les bords de la rivière Hopper. Pour ceux qui ignorent qu'ils ont été abandonnés là par Richardson, la méprise serait bien permise.

Les voyageurs ne tardèrent pas à jeter par terre les sacs de pemmican pendus à leur cou, car les caribous et les bœufs musqués abondaient.

La chair de caribou bien apprêtée, sans être un mets exquis, se mange facilement et soutient beaucoup.

Le bœuf musqué est détestable; on ne se résigne à en manger que pour sauver sa vie. Le cœur bondit en approchant des lèvres cette chair fétide. Les sauvages pourtant en font une grande consommation et la trouvent délicieuse. Le caribou est gras l'automne. L'hiver il vit de mousse blanche, de lichens, de bourgeons et d'écorce de petits arbrisseaux. Le seul bois que l'on rencontre dans cette région est l'épinette. Elle atteint en général un pied et demi de diamètre et seize pieds de longueur. Elle possède des rameaux touffus à l'ombre desquels les cariboux viennent s'abriter pendant les tempêtes si fréquentes dans ces parages.

Le pays est nu, stérile, couvert de rochers, parsemé d'étangs. On rencontre parfois quelques arpents qui pourraient être cultivés, mais ils ne constituent que comme des oasis au milieu de déserts affreux. Ils marchèrent ainsi 28 jours, inquiets et souvent découragés. Le froid était intense et les jours de courte durée. Grâce aux aurores boréales, ils pouvaient cependant continuer leur route pendant une partie des nuits. Une couverte en laine à cette latitude, est une bien faible protection contre le froid; Bruce put en faire l'expérience plusieurs fois.

La 28e journée, ils entendirent un coup de fusil. Ils constatèrent bientôt qu'il provenait de sauvages qui arrivaient du fort et qui faisaient la chasse. Trois d'entre eux s'offrirent à les guider. Deux jours après, ils atteignaient enfin le fort du lac de l'Ours où les attendaient leurs treize compagnons.

Quelque temps après leur arrivée, tous les hommes reçurent l'ordre de se rendre au fort Simpson. Bruce resta au lac de l'Ours avec Richardson, Rae et quatre autres.

Le fort consistait en deux maisons et un hangar. Comme les maisons n'étaient faites que de bois équarri, à travers lequel soufflait la bise du nord, Bruce jeta de l'eau dans les fissures. L'eau, en se congélant, servait de mortier et empêchait l'air de pénétrer, tandis que les peaux de caribou tenaient lieu de chassis. Comme ils ne possédaient pas de poële, ils faisaient un feu de cheminée, comme dans les châteaux du moyen âge. Le combustible était rare et ce n'était que sur les bords de la rivière Dease qu'ils pouvaient en trouver en quantité suffisante. Ils demeurèrent 18 jours sans voir le soleil. Le dix-neuvième jour, ils aperçurent le disque du soleil se dessiner un moment à l'horizon, pour disparaître l'instant d'après. Ce fut une fête parmi les Esquimaux qui avaient hiverné sur la rivière Dease.

Ils se réunirent auprès du fort, poussant des cris de joie, dansant et faisant les contorsions les plus ridicules.

Bruce profita de cette circonstance pour aller les visiter dans leur cabane de glace. L'intérieur était tapissé de peaux de caribou.

L'odeur nauséabonde qui saisissait, en entrant dans ces blanches demeures, avait quelque chose de repoussant.

Il fallait être habitué à ce milieu-là pour y résister longtemps. Sans être bien chaudes, ces demeures sont pourtant tolérables, et lorsque les Esquimaux ont assez de prévoyance, ce que l'on rencontre assez rarement chez eux, pour se pourvoir des provisions nécessaires pour l'hiver, ils sont relativement assez heureux. Le 14 février 1851, Richardson, Bruce et trois autres partirent pour le fort Norman. Ils couchèrent deux nuits sur le lac de l'Ours et faillirent y périr de froid. Parvenus enfin au fort Norman, ils retournèrent à la Rivière-Rouge, par la même route qu'ils étaient venus. Jean-Baptiste Bruce arriva à Saint-Boniface au mois d'août, après avoir fait un des voyages les plus hardis que l'on puisse mentionner, après avoir navigué un mois sur la mer polaire, être tombé plus de vingt fois à l'eau, avoir été emporté plusieurs fois par la vague ou le vent, avoir vu la mort en face à chaque instant et, enfin, après un mois et demi de marche à travers des solitudes désolées. Richardson, qui avait appris à apprécier les qualités de cœur et le courage à toute épreuve de son guide, voulut l'emmener avec lui en Angleterre pour l'attacher définitivement à son service. Bruce refusa, aimant mieux vivre et mourir au pays de ses ancêtres.

Bruce vécut de longues années après cette expédition, sur sa terre à Saint-Boniface, dans une honnête aisance, entouré du respect de ses concitoyens. Il conserva dans sa vieillesse une mémoire heureuse et une excellente santé, fruits d'une vie laborieuse et frugale. Toute une génération passa sous ses yeux et il faisait bon de l'entendre décrire lui-même les incidents de cette expédition dont je n'ai pu esquisser que les grandes lignes, et raconter les vieilles histoires d'une époque disparue pour toujours et dont les souvenirs s'effacent chaque année.

Jusqu'à sa mort, Bruce fut considéré à bon droit comme le guide le plus intrépide, le plus habile et le plus sûr de tout le Nord-ouest. Quoique d'origine écossaise du côté paternel, par sa langue, ses alliances et son affection, il appartenait à la fière race des métis canadiens-français.

Il mourut à Saint-Boniface, le 19 septembre 1890. Il fut toute sa vie un catholique fervent et un citoyen intègre.

II. Jean-Louis Légaré.

Cet homme de bien n'a été qu'un modeste traiteur des prairies, qui a passé une partie notable de sa vie au milieu des tribus indiennes de l'Ouest.

Qui ne connait pas "Jean-Louis" à la Montagne-de-Bois et dans toute la région avoisinante ?

Le prestige dont il jouissait au milieu des sauvages, le dévouement dont il fit preuve en défendant leurs droits et en se constituant leur avocat à Washington lui méritaient déjà une mention spéciale. Mais le seul fait d'avoir livré au Fort Buford le célèbre "Bœuf-Assis" ainsi que les Sioux qui l'accompagnaient, constitue une action assez éclatante pour lui assigner une place d'honneur parmi les anciens de l'Ouest qui ont bien mérité de leur pays.

Jean-Louis Légaré naquit à Saint-Jacques-de-l'Achigan (P.Q.) le 25 octobre 1841, du mariage de François-Xavier Légaré et de Julie Mélançon. Son père était cultivateur, avec peu de biens, mais assez d'enfants. En 1848 il alla se fixer à Saint-Gabriel-de-Brandon.

A cette époque, nos campagnes se dépeuplaient au profit des usines américaines. La fièvre des voyages à l'étranger sévissait partout, mais surtout parmi la jeunesse. Lorsque le soleil torride du printemps de la vie monte à l'horizon, l'homme qui commence à prendre possession complète de ses facultés, éprouve un moment de vertige et d'éblouissement.

Milton nous représente l'homme au sortir des mains de son créateur, se levant du néant sous les ombres de l'Eden, dans toute la splendeur virginale de son être encore frémissant du toucher divin, et il lui prête ces paroles "Je contemplai alors le ciel et je m'élançai d'un bond comme pour l'atteindre."

L'état d'âme des jeunes gens de la province de Québec, à cette date de notre histoire, présentait, dans un certain sens, une analogie avec ce tableau. Les Canadiens-français étaient pour ainsi dire hantés par le spectacle des richesses manufacturières des Etats-Unis. L'attirance de cette vision fascinatrice était telle qu'on aurait cru vraiment qu'ils étaient secoués par la frénésie de franchir la ligne internationale. L'illusion d'une vie plus facile, de revenus à périodes fixes, et constants, et le mirage de fortune rapide, ensorcellaient notre population comme la voix des sirènes de la fable.

A tous les printemps un essaim nouveau secouait ses ailes pour s'envoler dans la même direction. Ah! si, au lieu de nous répandre çà et là dans la république voisine, nous avions imité le chêne qui, assis sur la colline, replie ses branches, comme un lutteur ses coudes, pour soutenir le choc de la tempête, nous n'aurions pas à déplorer aujourd'hui des entailles si cruelles dans nos libertés les plus chères et dans nos institutions qui s'identifient le plus intimement à notre vie nationale.

Jean-Louis n'échappa pas au microbe, et, à l'âge de 24 ans, il prit le chemin des Etats-Unis. Il demeura deux ans dans les prin-

cipales villes de l'Etat de New-York, qui lui plurent à demi. Il n'avait pas encore trouvé sa voie.

Enfin, il se dirigea vers l'Ouest, et s'établit près de Saint-Paul, à un endroit connu sous le nom de " Petit-Canada " à cause du grand nombre de Canadiens-français qui y avaient planté leur tente.

D'ailleurs Jean-Louis avait déjà deux de ses oncles qui l'avaient dévancé au Petit-Canada, et lui avaient adressé des lettres pressantes de venir les trouver.

Le printemps suivant, après avoir humé l'air frais des prairies, il se sentit grisé par les séductions de la vie facile et sans contrainte de l'Ouest.

Il partit de nouveau pour s'enfoncer dans l'intérieur de ces plaines vastes comme l'océan, qui l'attiraient de plus en plus.

Il s'arrêta un moment à Saint-Cloud qui ne se composait alors que de quelques chétives cabanes. Il y rencontra un Métis du nom de Pierre Laverdure qui lui parla avec avantage du Dakota.

Il le suivit jusqu'au lac du Diable, appelé par les Américains " Fort Talton ".

Un traiteur du nom d'Antoine Ouellette, qui faisait le commerce des pelleteries avec les Sioux, lui offrit de l'emploi. Légaré accepta.

C'était une vie rude que celle qu'il venait d'embrasser et qui détonnait avec l'existence calme et paisible de cultivateur qu'il avait menée dans sa jeunesse.

Courir les buffles, voyager au milieu de tribus cruelles, presque toujours en guerre entre elles, se nourrir de viande sèche et de pemmican, errer sans cesse dans les prairies et perdre souvent, par la perfidie des sauvages, le fruit de longs mois de labeur et de privations; tels étaient en général les perspectives et l'aléa de la vie de traiteur.

Au cours de ses voyages, il fit connaissance avec la tribu des Santés, qui se lia d'amitié avec lui. Ses manières affables, sa probité dans le commerce, sa grande libéralité, la douceur de son caractère, son respect pour les traditions et même les préjugés des sauvages, et l'exactitude scrupuleuse avec laquelle il s'acquittait en tout temps de ses promesses, ne tardèrent pas à lui attirer la confiance et l'estime des Sioux.

Fort-Totton n'est éloigné que d'environ 60 milles de la frontière. Or, comme cet endroit était le siège des affaires de son patron, Légaré eut l'occasion de traverser souvent la frontière, à la suite des troupeaux de buffles et de rencontrer les Cris qui demeuraient sur la terre canadienne. En peu de temps, Légaré put converser facilement en sioux et en cris.

Un jour, Ouellette envoya Légaré avec nombre de charettes, transporter des pelleteries à Saint-Paul.

C'était en 1870. Légaré rencontra, à Saint-Paul, George Fisher, de la " Prairie du Cheval Blanc " (aujourd'hui Saint-François-Xavier) Manitoba. Fisher faisait la traite parmi les sauvages du Nord-ouest canadien. Il offrit à Légaré d'entrer en société avec lui. Légaré accepta et tous deux allèrent se fixer à la Montagne-de-Bois. Cette montagne était le rendez-vous des hivernants de la Rivière-Rouge. Ils se trouvaient ainsi tout rendus au printemps lorsque les innombrables troupeaux de bisons traversaient le Missouri pour se déverser dans les prairies canadiennes.

D'ailleurs, çà et là, dans les endroits boisés, les chasseurs, même en hiver, pouvaient encore abattre quelques têtes et alimenter le pot-au-feu. Le poste de la Montagne-de-Bois fut l'un des premiers autour duquel les anciens du pays commencèrent à se fixer en nombre, pour former plus tard, sur la Saskatchewan et ailleurs, les premières paroisses métisses en dehors de la colonie de la Rivière-Rouge.

Dès lors Légaré embrassa la carrière de traiteur irrévocablement. Sa forte constitution, son mépris des dangers, ses connaissances des mœurs et du caractère des sauvages en faisaient déjà un maître dans cette carrière.

Au printemps de 1872, il épousa Marie Ouellette, nièce de son ancien patron, et s'établit permanemment à la Montagne-de-Bois qu'il ne devait plus quitter.

A tous les printemps, il se rendait à Winnipeg avec plusieurs charges de peaux de buffle; à l'automne il revenait avec du pemmican et de la viande sèche. Il rapportait en échange des marchandises qu'il trafiquait de nouveau pour des peaux ou du pemmican.

En 1872, il était considéré comme un des traiteurs les plus riches du pays. Il acheta, à l'automne de cette année-là, pour $14,000 de marchandises.

Un accident regrettable le ruina d'un seul coup. De retour à la Montagne-de-Bois avec ses $14,000 de marchandises, il se laissa persuader d'aller hiverner à la Rivière-Blanche, communément appelée "Maison-de-Terre," où se trouvait un camp nombreux de sauvages et de métis.

A cette époque un parti d'arpenteurs était occupé à indiquer la ligne internationale entre le Canada et les Etats-Unis. Il se trouvait à environ 100 milles de la Rivière-Blanche et il était bien difficile de fixer, avant cet arpentage, l'endroit exact où se trouvait la frontière. Craignant d'être inquiété dans son commerce, Jean-Louis s'adressa à l'agent des sauvages de Fort-Peck, lui demandant s'il pourrait trafiquer à l'endroit où il se trouvait, en attendant la délimitation

de la frontière. On croyait généralement que la Maison-de-Terre se trouvait sur le territoire anglais. Aussi bien l'agent n'hésita pas à lui répondre qu'il n'y avait aucune objection à la chose et que, en tout cas, il verrait à ce qu'il ne fût pas troublé.

Jean-Louis continua donc à faire la traite, sans aucune appréhension, lorsque, le 3 mai 1873, toutes ses marchandises furent saisies sous prétexte qu'il faisait la contrebande et fraudait le gouvernement de ses droits de douane. Il eut beau représenter que la ligne internationale n'était pas encore tracée et qu'il avait agi avec la meilleure foi, rien n'y fit. Tous ses effets furent confisqués au profit du gouvernement. Il perdit de ce chef $9,000. Les Sioux comptaient 70 loges auprès de la Rivière-Blanche. En apprenant cette grave injustice, ils tinrent conseil. Le lendemain ils se rendirent auprès de leur ami Jean-Louis et lui proposèrent de tuer tous les Américains et de lui rendre ses marchandises. Ces sauvages étaient bien armés et très indignés de ce qu'ils considéraient comme un vol à peine déguisé. Les Américains n'avaient à ce poste qu'une escouade de neuf soldats. Les Sioux n'auraient pas eu grande peine à les exterminer.

Heureusement que Jean-Louis préférait être ruiné par la plus grande des injustices plutôt que de verser le sang; toutefois il aurait pu difficilement contenir les sauvages, s'il n'eut été assisté par le P. Lestanc, O.M.I.

Ce zélé missionnaire jouissait d'un grand prestige auprès des Sioux qui éprouvaient pour lui un respect religieux. Il les réunit et dut employer toute son influence pour les empêcher de lever la hache de guerre.

Les Sioux demeurèrent tranquilles, mais Légaré perdit tout.

Les années 1874 et 1875 furent excellentes pour la traite. Le "pelu," comme disaient les anciens du pays, fut abondant et Jean-Louis put réparer les malheurs qu'il avait éprouvés à la Rivière-Blanche.

Un jour, c'était le 25 août 1875, les métis et les Sauteux de la Montagne-Tortue, du côté américain, ayant à leur tête leur chef, La Petite-Coquille, se rendirent en députation auprès de Légaré à la Montagne-de-Bois.

Connaissant son dévouement envers les sauvages, ils venaient le prier d'aller avec eux à Washington pour obtenir une réserve et une indemnité. La Petite-Coquille, s'adressant à Jean-Louis, lui dit: "Nous n'en voulons pas d'autre que toi, car c'est à toi seul que nous pouvons nous fier. Tu sais ce qu'il faut aux enfants de la prairie, car tu as vécu avec tes frères les Indiens depuis plusieurs années."

Les Sauteux avaient l'assurance que le gouvernement américain paierait leurs frais de voyage.

Ils étaient six de cette expédition, la première venue de cet endroit: Le Petit-Bœuf, Cassepas, Chasseur, La Petite-Coquille le chef, Joseph Rolette l'interprète, et Jean-Louis Légaré qui devait leur servir de mentor.

Les Sauteux avaient reçu certaines promesses de E. P. Smith, alors commissaire des sauvages à Pembina, et espéraient qu'il leur avancerait les deniers nécessaires pour couvrir les dépenses de cette délégation. Smith refusa. Ils s'adressèrent en vain au Département de l'Intérieur à Washington et firent télégraphier par l'agent des sauvages à "La Terre Blanche." Ils ne reçurent pour toute réponse que cette délégation était inutile, qu'ils recevraient leur traitement annuel et que cela devait suffire. Légaré n'était pas homme à s'arrêter en chemin, une fois qu'il avait entrepris une affaire. Il avança les deniers nécessaires à La Petite-Coquille, contribua largement à payer les billets de voyage des autres délégués et tous se mirent en route vers le Capitol américain. Ils arrivèrent le 9 janvier 1876. Jean-Louis, le traiteur, se révéla tout d'un coup diplomate.

Il était le seul membre de ce parti qui fût instruit, c'est pourquoi le chef de la tribu lui avait confié le soin de faire valoir les droits de sa nation. Il s'en acquitta avec succès. Il s'adressa d'abord aux députés du Dakota. Ces derniers appuyèrent sa demande et lui prêtèrent leur concours. C'est Jean-Louis qui prépara lui-même les documents, et les soumit ensuite au comité des affaires indiennes. Il s'était associé le Révérend Père Brouillet qui retouchait ses mémoires et l'aidait de ses conseils. Pendant son séjour à Washington, Jean-Louis fit connaissance avec l'honorable Bougie, sénateur pour Saint-Louis (Missouri.) Il voulut que ce fût ce Canadien-français qui se chargeât de présenter la demande des sauvages devant le Sénat. Le succès couronna ses efforts. Légaré obtint pour ses Sauteux une réserve, une annuité pécuniaire, et de plus une certaine somme pour permettre aux sauvages de se livrer à l'agriculture. Les délégués sauvages reçurent $1,000 pour défrayer leur voyage mais Jean-Louis fut le seul oublié dans cet acte de justice.

Le 8 avril 1876, il revenait chez lui, après avoir dépensé tout ce qu'il possédait, dans l'intérêt d'une tribu oubliée de tout le monde.

Le gouvernement canadien se montra plus généreux et lui donna un contrat pour approvisionner de pemmican cinq postes du Nord-ouest.

Jean-Louis retourna à la Montagne-de-Bois, emportant pour toute richesse la reconnaissance des Sauteux.

A l'automne de 1876 les Yanktons, tribu des Sioux, lui demandèrent d'hiverner avec lui à la Montagne-de-Bois. Il n'y avait à cette date que cinq familles métisses à cet endroit. Jean-Louis perdit sa femme peu de temps après.

Au mois de janvier 1877, les premiers Titons, autre tribu des Sioux, à laquelle appartenait le célèbre Bœuf-Assis (*Sitting Bull*), traversèrent la frontière.

C'était la première fois que cette tribu foulait le sol britannique. Ils étaient douze à cheval, avec leur chef, le Petit-Couteau.

Jusqu'alors Jean-Louis n'avait traité qu'avec les Yanktons et les Santés, qu'il connaissait tous par leur nom. Il n'en était pas ainsi des fiers Titons. Ces rudes gaillards n'étaient pas commodes à pratiquer. Ils avaient le cou raide, et la main toujours prête à frapper, au moindre signe provocateur. Ils étaient en rupture de ban avec la civilisation et exaspérés contre les Américains.

Le Petit-Couteau, arrivé à la demeure de Jean-Louis, entra seul; ses compagnons l'attendaient à une courte distance, inquiets de l'accueil qu'il allait recevoir.

Il portait une carabine américaine qu'il avait ramassée lors du désastre du général Custer, et une belle bague au doigt. Il avait l'air effrayé et craintif. Il était évident qu'il n'était pas habitué à rencontrer un blanc.

En entrant, il promena ses regards de tous cotés, mit la main à sa carabine, comme s'il appréhendait une attaque.

Il faisait un pas, s'arrêtait quelques instants, l'œil au guet, et avançait encore lentement le pied, comme un chat qui s'approche d'une souris.

Arrivé au fond de la salle, il s'assit, se leva l'instant d'après, sans prononcer un mot, et fit signe de la main à ses compagnons d'approcher.

Ils entrèrent un par un et s'assirent en cercle.

Le Petit-Couteau se leva alors solennellement et alla présenter la main à Jean-Louis. Tous ses compagnons en firent autant.

Quelques-uns d'entre eux avaient des montres en or ou en argent; d'autres des chemises brodées.

Ils s'étaient revêtus des dépouilles des soldats américains tombés sous leurs coups. Le Corbeau, leur orateur, se leva et fit un discours.

" Nous avons laissé les Buttes-Noires, notre pays, dit-il, parce que les Américains sont trop méchants. Nous ne pouvons plus dormir. Nous avons entendu dire que la Grande Femme avait tous ses enfants en paix. Nous sommes venus de ce côté-ci de la ligne, afin que nos enfants puissent dormir sans inquiétude. Nous voulons ouvrir commerce avec toi; c'est pour cela que nous t'avons donné la main.

Nous voulons avoir du tabac, du thé, des munitions pour chasser et vivre tranquilles dans ce pays ".

Jean-Louis leur distribua des présents et ils retournèrent satisfaits à leurs loges qui étaient à 15 milles de là.

Ils revinrent bientôt camper avec 70 loges. Au cours de l'hiver, ils traversèrent la frontière par petites bandes. Au printemps de 1877 une grosse bande passa par la Rivière-au-Lait. Le Bœuf-Assis se trouvait parmi ces derniers. Les Titons comptaient alors 800 loges campées auprès de la maison de Légaré, à la Montagne-de-Bois.

Ces sauvages n'avaient vécu, pour ainsi dire, que de pillage, tuant les colons ou les mineurs et s'emparant de leur bagage. Aussi bien n'avaient-ils pas la moindre idée du commerce et de la valeur de l'argent.

Jean-Louis dut user de beaucoup de prudence et de patience pour traiter avec eux. Souvent ils venaient à son magasin et pour une maigre peau de $4.00, ils lui demandaient de $25 à $30 d'effets. On comprend dans quelle position Légaré se trouvait, avec des "clients" aussi grossiers.

Quand il refusait de vendre à leur prix: " Eh bien, disaient-ils, moi je te donne cette peau, toi maintenant, donne-moi, à ton tour, ce dont j'ai besoin ". Parfois ils venaient chercher de la mélasse dans des sacs de coton. Jean-Louis les renvoyait alors chercher leur cruche qui consistait en une panse de buffle.

Les Titons, d'après le témoignage de Légaré, étaient cruels et en général peu intelligents, mais tous bons cavaliers et habiles chasseurs. Ils tiraient avec une précision remarquable. Tous ceux qui se trouvaient à la Montagne-de-Bois avaient pris part à la fameuse bataille ou périt le général Custer. Ils détestaient en général les blancs. S'ils ne se livraient pas au pillage, leur passe-temps favori, c'est qu'ils craignaient d'armer les Canadiens contre eux et d'être contraints de retourner aux Etats-Unis. Ils se montraient assez bien disposés envers les métis, parce que ces derniers étaient généreux pour eux.

Ils les nourrissaient et partageaient souvent avec eux le peu qu'ils possédaient. Les métis ont hérité de leurs pères canadiens-français cette hospitalité excessive qu'on retrouve parmi nos paysans.

Les chefs titons les plus renommés étaient: Les Quatre-Cornes, La Lune-Noire, Le Chien-Long, Le Petit-Couteau, Le Bonnet-d'Ours, Le Chien-Bas, Le Bel-Ours, Pas-de-Cou, L'Aigle-Caille, La Corne-Rouge et Le Tonnerre-Rouge.

Le Bœuf-Assis avait pour chef Les Quatre-Cornes. Les deux tribus les plus cruelles et les plus féroces étaient La Lune-Noire et les Quatre-Cornes.

Les chefs étaient héréditaires chez eux. Le Bœuf-Assis n'était que soldat de guerre. Ce qui lui a valu sa réputation, c'est son extrême prudence, son éloquence entraînante et ses ressources ingénieuses dans les dangers. Un jour, il avait demandé effrontément à un agent des sauvages d'écrire au Président de laisser pousser les cheveux à ses soldats, avant de les envoyer en guerre, pour qu'il eut une meilleure chance de les scalper.

Les Sioux disaient qu'il avait la *parole forte* dans les conseils. D'un caractère sombre et taciturne, il ignorait ce que c'est que la reconnaissance et était rusé comme un renard. A ses heures, il parlait avec une chaleur communicative et une grande véhémence.

Il avait tué un grand nombre de blancs, mais il n'aimait pas à s'en vanter, pendant qu'il était en Canada, craignant que cette gloire peu enviable ne lui suscitât des misères. Lorsque les Titons traversèrent la frontière, le Bœuf-Assis n'était pas bien vu des siens. Les chefs étaient jaloux de lui et ne pouvaient lui pardonner de ce que lui, simple soldat, avait acquis une réputation supérieure à la leur. Toutefois son ascendant etait tel qu'il fut considéré virtuellement comme le chef des Sioux, quoique, de fait, il ne reçut aucun des honneurs réservés aux chefs.

On se rangeait toujours de son avis et rien ne se faisait sans qu'il fût préalablement consulté.

Les chefs portaient des plumes à leurs cheveux; le Bœuf-Assis se contentait d'un mouchoir d'indienne qui lui ceignait la tête. Il avait alors environ 50 ans, mais, comme chez la plupart des sauvages, ses cheveux n'avaient pas blanchi. Il portait toujours une couverte noire et un grand calumet. Il avait deux femmes et sept enfants, dont quatre étaient sourds et muets. Il recevait beaucoup de présents qu'il distribuait libéralement à ses compagnons; ce qui contribuait beaucoup à lui gagner l'estime des siens. Pendant l'hiver de 1877, le major Walsh se rendit au camp des Sioux et les visita. Ils tinrent conseil et le major leur porta la parole. Il leur dit qu'il leur permettrait de demeurer dans le pays, à la condition qu'ils en observeraient les lois. Ils ne firent guère cas de sa harangue, et, après son départ, le Bœuf-Assis dit à Légaré en souriant: "Nous ne prenons pas la parole d'un blanc, mais nous le jugeons par sa conduite."

Pendant cet hiver, Légaré acheta 4,000 peaux de buffle qu'il paya de $4 à $5 chaque. L'été suivant, il descendit à Winnipeg avec 2000 peaux, mais il ne put obtenir que $2.50 de la Compagnie

de la Baie d'Hudson et perdit $12,000 par suite de la baisse dans le prix des pelleteries.

A l'automne de 1877, la police à cheval construisit un fort à la Montagne-de-Bois et y maintint une garnison. La conduite de la plupart des membres de cette garnison ne fut pas de nature à donner aux sauvages une idée favorable des blancs. La licence scandaleuse des soldats et le mépris avec lequel ils traitaient les sauvages, les rendirent odieux aux Sioux.

Ils étaient d'ailleurs trop peu nombreux pour maintenir l'ordre et malheureusement assez nombreux pour les troubler par leur manière hautaine.

Un jour, les Sioux firent une incursion sur le territoire américain. Le général Mills se mit à leur poursuite. Ils retournèrent en toute hâte à la Montagne-de-Bois. Jean-Louis se trouvait en ce moment en voyage au lac Qu'Appelle. A son retour, le Chien-Long alla le trouver. "Il y a deux jours et deux nuits, dit-il, que nous n'avons pas dormi dans le camp. Les Américains sont prêts de la ligne et nous craignons qu'ils la traversent pour nous prendre. Quand tu m'auras dit ce que les Américains vont faire, je dormirai." Jean-Louis les rassura en leur disant que tant qu'ils demeureraient sur le territoire anglais, ils n'avaient rien à craindre. Le Chien-Long retourna au camp et le calme fut rétabli. Ce trait indique le crédit dont il jouissait parmi les Sioux. On ne croyait pas qu'il pût tromper ni se tromper. Le major Walsh reconnut lui-même l'influence de Légaré, en lui demandant d'agir comme intermédiaire entre lui et les Sioux et en lui confiant plusieurs missions importantes.

Au printemps de 1880, le major Walsh fit arrêter l'un de ces sauvages pour vol et le fit incarcérer dans le fort. Grand fut l'émoi parmi les Sioux qui tinrent conseil. Le Bœuf-Assis voulait attaquer le fort et exterminer tous les membres de la police. Dans cette extrémité, Walsh s'adressa à Légaré comme le seul homme qui pût sauver la situation. Jean-Louis, d'après l'opinion du major, valait mieux que les remparts du fort et les soldats qui les défendaient. Jean-Louis, en effet, réussit à faire entendre raison au Bœuf-Assis et, le lendemain, la bonne entente était de nouveau rétablie.

Pendant l'hiver de 1880, les Sioux souffrirent de la faim, ne mangeant que des chevaux morts. Jean-Louis fut obligé de leur donner souvent des sacs de farine, pour les empêcher de mourir de faim. A l'automne de cette même année, ils traversèrent la frontière, courant le buffle. Le Bœuf-Assis se rendit à la Pointe-aux-Loups, mais il fut mal reçu par les Assiniboines qui tirèrent sur lui et tuèrent son cheval. Au mois de janvier 1881, un Américain du nom d'Allison

fit des efforts auprès du Bœuf-Assis pour le persuader de se livrer ou pour le faire tomber dans quelque piège.

Le Bœuf-Assis accepta tout ce que lui donna Allison, promit tout et comme d'habitude ne tint rien.

Néanmoins il commit l'imprudence d'aller chasser de nouveau du côté américain et s'il n'eût été averti à temps par un membre de sa bande, il eût certainement été pris par les troupes américaines. Il fut poursuivi jusqu'à la frontière et n'échappa que grâce à l'agilité de son coursier.

Le major Croziers, qui avait succédé au major Walsh au poste de la Montagne-de-Bois, essaya de négocier un arrangement entre le Bœuf-Assis et le major Brotherton qui commandait au fort Buford.

Il lui proposa d'envoyer quelques hommes de la police s'entendre avec le commandant américain. Il finit par consentir, mais à la condition que trois Sioux et Joseph Morin, qui devait agir comme interprète, feraient partie de l'expédition. Le capitaine A. R. MacDonnell, accompagné de deux soldats, trois Sioux et Joseph Morin, se rendit donc au fort Buford.

A leur retour, ils remirent au major Croziers une lettre du major Brotherton qui faisait les offres les plus généreuses au Bœuf-Assis, s'il voulait se rendre, promettant de le traiter avec tous les égards possibles.

En entendant la lecture de cette lettre, le Bœuf-Assis devint furieux et dit à haute voix: "Ce n'est pas vrai, ce n'est pas une lettre du major Brotherton. Elle a été fabriquée le long du chemin. Vous avez bu tout le temps et je ne prends pas votre parole." Il paraîtrait qu'il avait été informé de ces faits par les trois Sioux. Les Titons se trouvaient alors dans un dénuement complet. Ils se rendirent devant la porte de Légaré, se mourant de faim et implorant secours. La situation n'était pas gaie.

D'un côté les Titons affamés et menaçants, d'un autre les métis pillés par eux, qui parlaient de s'éloigner et, ce qui était plus grave encore, les Cris, à la veille d'entrer en guerre avec les Titons et qui avaient déjà commencé par en tuer un. D'un côté de la ligne, la police à cheval ne voulait ni les aider, ni les voir, et de l'autre, les Américains, les armes à la main, les attendaient de pied ferme. Et puis les provisions allaient bientôt être épuisées. Un sac de farine se vendait déjà $12.00.

Que faire en pareille occurrence? Légaré fut l'homme de la situation. Il réunit les Sioux et leur tint ce discours: "Voilà cinq ans que vous êtes avec moi. J'ai toujours été votre conseiller. Vous n'avez plus d'amis dans le pays, à part moi. Vous vous méfiez de tout le monde et tout le monde se méfie de vous. Je vais vous don-

ner un conseil que vous devrez suivre, si vous ne voulez pas tous mourir de faim ici. C'est de vous rendre aux autorités américaines, pendant qu'elles sont disposées à vous recevoir." Il offrit d'aller avec douze d'entre eux voir le major Brotherton, de les nourrir pendant le vogage et de leur procurer les munitions nécessaires pour se défendre, au cas d'attaque. Les Sioux acceptèrent. Il partit avec trente Titons. Le soir, pendant qu'ils étaient campés, quelques cavaliers envoyés par le Bœuf-Assis les atteignirent.

Ils avaient reçu l'ordre de ramener le fils de la Lune Noire, disant qu'il avait tué trop d'Américains, que $200 avaient été offertes pour sa tête et qu'ils craignaient qu'il ne fût tué, après avoir traversé la frontière. Plusieurs Titons furent effrayés de ce message et abandonnèrent Jean-Louis.

Quand il fut rendu au fort Buford, il n'avait plus que seize sauvages avec lui.

Il y avait déjà 1300 Sioux qui étaient gardés à ce fort et le général Terry avait donné l'ordre de ne laisser sortir aucun Titon qui entrerait dans le fort.

Jean-Louis vit aussitôt le major Brotherton. Ce dernier l'assura que le Bœuf-Assis et ses compagnons pouvaient se rendre sans crainte et qu'ils seraient bien traités. Jean-Louis expliqua au major qu'il voulait ramener les seize Titons qui l'avaient accompagné, afin qu'ils pussent annoncer eux-mêmes cette bonne nouvelle et raconter la manière dont ils avaient été traités au fort.

Brotherton y consentit.

Douze compagnons de Jean-Louis préférèrent rester. Les quatre autres le suivirent. De retour à la Montagne-de-Bois, Jean-Louis fut surpris d'apprendre que le Bœuf-Assis était parti avec trente loges pour le lac Qu'Appelle, pendant son absence. Les Sioux refusèrent de faire quoi que ce fut avant le retour de Bœuf-Assis. Cependant, à force de présents, il réussit, à la fin de mai, à partir avec 48 Sioux. Il les mena au fort Buford où ils furent bien accueillis.

A ce moment, tous les yeux étaient tournés vers Légaré, comme étant le seul homme qui eût assez d'ascendant sur les Sioux pour les ramener sur le territoire américain et débarrasser le Canada de ces hôtes malcommodes et dangereux.

Voici d'ailleurs ce que le major Crozier écrivait à ce sujet:

Montagne-de-Bois, ce 20 avril 1881.

Mon cher M. Légaré,

"Nous recevons les lettres les plus encourageantes du Missouri. Les sauvages sont traités aussi bien qu'il est désirable et les Américains se montrent aussi bons que possible envers eux.

En dépit de tout ce qui a été fait pour lui, le Bœuf-Assis désire demeurer encore dans le pays, s'il le peut. Je pense cependant qu'il sera obligé, vu ce qui se passe en ce moment, de suivre les autres. Si vous lui parlez, ce sera de nature à le faire considérer comme un chef, aux yeux de ses gens et à augmenter son influence. Il se servira de cette influence ensuite pour retenir ses compagnons ici.

Je désirerais que vous envoyiez un message à la Pointe-aux-Trembles ou à Buford, pour avertir l'officier américain du nombre de sauvages que vous avez avec vous. Les Américains vous enverront des provisions et des voitures pour emmener vos sauvages.

Vous pouvez compter que je paierai le prix dont vous aurez convenu pour le messager.

Je vous envoie ci-inclus la copie d'une lettre reçue du major Brotherton.

Ne faites pas savoir aux sauvages que vous avez reçu une lettre de moi. Vous savez comme ils sont soupçonneux. Ils pourraient s'imaginer que nous avons quelques projets en vue. Je vous écris ceci, parce que le Bœuf-Assis pourrait vous tromper. Vous ne pouvez pas croire un seul mot de lui. Je vous récompenserai, bien entendu, pour la peine que vous vous donnez dans cette affaire et je ne manquerai pas d'informer le gouvernement de l'aide puissante que vous nous avez donnée.

Votre tout dévoué,

MAJOR CROZIER.

On voit par cette lettre combien les autorités canadiennes et américaines comptaient sur Légaré pour livrer les Sioux au fort Buford. Le major Crozier craint même que les sauvages apprennent qu'il s'est mêlé de cette affaire et que son intervention soit mal vue par eux. Il n'est pas étrange qu'on soit surpris, après semblable aveu de la part du major Crozier, de lire dans certains journaux aux Etats-Unis et au Canada, que la reddition du Bœuf-Assis et de ses compagnons a été l'œuvre de cet officier. Comment Crozier aurait-il pu livrer le Bœuf-Assis, le plus rusé et le plus redoutable guerrier sioux, quand il s'adressait à Légaré pour faire rendre les autres ?

D'ailleurs les faits qui vont suivre établissent au delà de tout doute possible que ce fut Légaré seul qui ramena sur le territoire américain tous les Titons, y compris le Bœuf-Assis.

Avant de quitter le fort Buford lors de son second voyage, le major Brotherton promit à Légaré de voir le général Terry et de lui demander de le récompenser suivant son mérite. "Si vous nous amenez le Bœuf-Assis, dit-il, vous pouvez compter que le gouvernement n'oubliera pas un tel service."

Dès son arrivée à la Montagne-de-Bois, le Bœuf-Assis vint le trouver et l'accusa d'avoir livré sa fille aux Américains.

Jean-Louis lui expliqua qu'elle s'était rendue d'elle-même, avant même son arrivée au fort Buford.

Alors le Bœuf-Assis lui dit: "Si tu veux me donner ce que je vais te demander, je vais te dire ce que je prétends faire aujourd'hui." Il demanda dix sacs de farine et un grand repas pour tous ceux qui étaient là, environ 350 Sioux, avant de parler. Jean-Louis consentit à tout. Après le festin, Jean-Louis lui dit qu'il partirait pour le fort Buford dans sept jours, avec tous ceux qui voudraient l'accompagner.

Le Bœuf-Assis lui répondit alors: "Il n'y a que tes paroles et celles des prêtres que je mets de côté," voulant dire par là qu'il n'avait confiance qu'en eux, parce qu'ils ne l'avaient jamais trompé.

La veille du départ, le Bœuf-Assis demanda encore dix sacs de farine que Jean-Louis lui donna. Les Titons tinrent conseil et se rendirent au fort de la police à cheval, sans pouvoir rien obtenir. Les sept jours expirés, Jean-Louis se rendit au milieu des loges siouses. Il était le seul blanc et n'avait absolument personne pour l'aider. Il avait 35 charettes et deux wagons pour transporter les provisions. Les Sioux lui demandèrent des cartouches.

Il répondit qu'il leur en fournirait en cas de danger au cours du voyage. Le matin du jour fixé pour le départ, Bœuf-Assis se dit malade et refusa de partir. Il défendit à ses femmes de défaire la loge. Un bon nombre, entraînés par son exemple, en firent autant. Voyant qu'il ne pouvait décider le Bœuf-Assis à le suivre, Légaré se mit en route avec 25 charettes.

Le Bœuf-Assis, le Tonnerre-Rouge et les Quatre-Cornes, suivis du reste des Titons, prirent une autre direction, disant qu'ils s'en allaient à la Rivière-au-Lait. Ils emmenaient avec eux une grande quantité de provisions et de chevaux qui appartenaient à Légaré. Ce dernier leur dépêcha quelques cavaliers pour leur demander de le suivre. Ils répondirent qu'ils ne voulaient pas le suivre dans cette direction. Il renvoya un plus grand nombre de cavaliers leur ordonner de laisser ce qui ne leur appartenait pas et demander à ceux qui étaient bien disposés de venir à lui.

Le Bœuf-Assis s'assit et se mit à fumer. Il tint conseil avec les deux chefs et il fut décidé de suivre les autres Sioux pendant quelque temps.

Le deuxième jour du voyage, les Titons commencèrent à voler les provisions de Légaré, et à les donner à un groupe de sauvages qui les accompagnaient jusqu'à la frontière.

Le soir, un Titon prit un sac de farine pour le donner. Jean-Louis lui défendit d'y toucher. Irrité, ce sauvage tira deux coups de fusil sur le sac, le trouant de part en part.

Des scènes de ce genre se répétaient à tous les jours. Il ne fallait rien moins que la patience et le courage de Jean-Louis pour diriger cette troupe désordonnée.

Cependant il fallait se hâter d'arriver au fort Buford, car les provisions menaçaient de manquer.

Légaré distribuait à tous les jours 1,000 livres de provisions, sans compter les cabris que tuaient les sauvages.

A tous les matins, 25 à 30 Sioux partaient en avant, comme éclaireurs. Il n'y a aucun doute que si un soldat américain s'était montré le long du voyage, les Sioux auraient soupçonné qu'on leur tendait un piège et auraient rebroussé chemin.

Le Bœuf-Assis semblait suivre les autres à regret et, deux matins, il refusa de défaire sa loge.

Il voulait retarder sous prétexte de fumer la pipe, tenir conseil ou boire du thé.

Le quatrième jour, Légaré envoya une lettre au major Brotherton, par un des Sioux. Il l'informait qu'il était en route avec le Bœuf-Assis, six chefs et deux cents Sioux et qu'il manquait de provisions. Mais il recommandait au major de ne pas lui envoyer de vivres par des officiers ou des soldats, de crainte d'effrayer les Sioux, mais de choisir plutôt des métis.

Voici la réponse que lui expédia le major Brotherton:

FORT BUFORT, DAKOTA.

Vendredi, 15 juillet 1881.

M. LÉGARÉ,

Cher monsieur,

Votre messager qui m'apportait de bonnes nouvelles, est arrivé hier soir. Ce matin je vous ai expédié des voitures avec des provisions, comme vous le demandez.

J'ai envoyé quelques soldats pour prendre soin des voitures sur la route, mais je n'ai pas envoyé d'officiers, vu que j'ai compris, d'après votre lettre, que vous n'en vouliez pas.

Les hommes en charge des voitures ont reçu instruction de se mettre sous vos ordres, de manière que vous puissiez disposer des provisions et les distribuer comme vous jugerez à propos. Je vous ai envoyé aussi un petit présent pour chacun des six chefs, suivant votre désir.

Vous pouvez leur dire que j'ai été autorisé par le chef du département à leur déclarer à tous, y compris le Bœuf-Assis, qu'ils seront bien traités ici, et qu'ils n'ont rien à craindre en y venant. Les voitures devront se rendre aussi vite que possible auprès de vous. Je serai heureux de vous voir, quand vous serez arrivé.

D. H. Brotherton,
Maj. Comd.

Le lendemain, les voitures arrivèrent. Elles étaient devancées par deux métis. Les Sioux, malgré les assurances de Jean-Louis, craignaient de voir arriver à tout moment les soldats américains. En apercevant les voitures, le Bœuf-Assis s'arrêta tout court et se frappa un grand coup sur la poitrine, en imitant le grondement sourd d'un ours et s'écria: "Voilà les Américains qui reviennent." Il se mit à courir autour des charrettes, parlant fort et exhortant les Sioux à retourner.

Les Quatre-Cornes, s'adressant à Légaré, lui dit en secouant la tête: "C'est pénible pour moi de retourner vers les Américains, quand je sens encore dans la hanche la balle qu'ils m'ont tirée". En effet, ce chef ne marchait qu'avec difficulté, à cause d'une blessure reçue en combattant contre le général Custer. Pour les calmer, Jean-Louis leur fit distribuer des vivres. Il avait avec lui six wagons chargés de biscuit, lard fumé, tabac, thé, couvertes, etc.

Le lendemain, les chefs tinrent conseil, mais cette fois, grâce aux secours que Jean-Louis avait reçus, la confiance commençait à renaître parmi eux et l'autorité de Jean-Louis était maintenant solidement assise.

A 35 milles du fort Buford, le capitaine Clefford vint à leur rencontre et demanda à Jean-Louis de lui indiquer le Bœuf-Assis.

Croirait-on que certains journaux américains annoncèrent que c'est à cet officier que revenait l'honneur d'avoir livré le Bœuf-Assis et que Légaré n'avait agi que comme espion ? Or le capitaine Clefford n'avait jamais vu la figure de ce sauvage, avant que Légaré ne le lui montre à 35 milles du fort.

Jean-Louis arriva avec le Bœuf-Assis, les chefs et tous les Sioux le 19 juillet 1881, à 11 heures du matin, au fort Buford et se rendit immédiatement devant la porte du major Bretherton. Ils furent bien accueillis et traités tel qu'il leur avait été promis.

Tous les employés du poste se portèrent vers Jean-Louis et lui demandèrent de leur montrer le fameux Bœuf-Assis, qui leur avait si souvent inspiré la terreur. Ils étaient dans l'admiration de voir cet homme (Légaré) sous des dehors si peu remarquables, qui avait accompli, à lui seul, ce que n'avaient pu faire Custer et les autres

officiers américains. Les Sioux livrèrent immédiatement leurs armes, à l'exception de Bœuf-Assis qui insista pour garder la sienne jusqu'au lendemain; ce qui lui fut accordé. Le lendemain, le Bœuf-Assis demanda à Brotherton de réunir tous les officiers et soldats du fort ainsi que les Titons. Il fit placer son enfant, âgé de huit ans, devant lui et, au milieu du plus profond silence, il remit son fusil à son enfant, en disant: " Va donner mon fusil au major. Tu ne seras jamais un homme, toi, mon fils, car tu n'auras jamais de fusil ni de chevaux ". Puis il s'adressa au major et dit: " Aujourd'hui je suis chez nous, car nous n'avons jamais vendu ce terrain. Quand je suis parti pour aller sur le territoire anglais, on ne pouvait plus dormir ici. Je voulais élever mes enfants dans la paix. Aujourd'hui je tiens l'Anglais et l'Américain dans la main". En disant ces mots, il étendait les bras du côté du Canada et des Etats-Unis et voulait dire qu'il se mettait ami avec les deux nations.

Le Bœuf-Assis demanda ensuite à faire des conventions de paix en présence de deux témoins et de Légaré. "Jean-Louis et les prêtres, dit-il, sont les seuls hommes en qui j'aie confiance." Il demanda à vivre libre dans les prairies et à y faire la chasse comme autrefois et avoir Jean-Louis pour traiter avec eux.

Tout lui fut promis. Après que l'assemblée fut dispersée, le Bœuf-Assis, voyant une sentinelle qui faisait la garde avec sa carabine, autour du camp, s'approcha d'elle et dit:" J'ai remis mon arme, moi, il faut que vous alliez livrer la vôtre, vous aussi."

Légaré partit quelques jours après.

Avant son départ, le major Brotherton lui remit un télégramme du général Terry lui disant qu'il serait récompensé pour le grand service rendu à la République américaine.

Le Nord-ouest anglais et le Nord-ouest américain lui doivent de les avoir délivrés des craintes d'un sauvage astucieux et dangereux qui aurait pu, pendant plusieurs années, avec sa tribu, être un sujet de terreur et de désordre parmi les colons. Par sa probité, sa franchise proverbiale, la droiture de son caractère et son influence sur les sauvages, il a pu, sans verser une goutte de sang, adoucir la nation la plus redoutable et la plus féroce qui ait jamais parcouru les prairies de l'Ouest, et la dominer jusqu'au point de la forcer à le suivre et à déposer les armes.

Cet honneur en vaut bien d'autres et mérite que le nom de Jean-Louis Légaré soit mieux connu parmi les vétérans de l'Ouest qui ont ouvert ce pays à la civilisation.

Saint-Boniface, 14 février 1914.

L.-A. PRUD'HOMME.

Les Indiens du Canada depuis la découverte.

Par C.-M. BARBEAU, de la Commission Géologique du Canada, Ottawa

Présenté par M. LOUVIGNY DE MONTIGNY, M.S.R.C.

(Lu le 27 mai 1914)

La découverte des Indiens du Canada, les aspects généraux de leur civilisation, la nature de leurs relations avec les Européens, et la décadence subséquente de leurs races et de leurs institutions constituent un sujet tellement vaste qu'il ne sera possible d'en tracer ici qu'un bref croquis.

I.

Les Scandinaves furent les premiers Européens qui découvrirent une tribu américaine. D'après deux relations authentiques, celle d'Adam de Brême (environ 1072 A.D.) et celle d'Ari Thorgilsson (environ 1133 A.D.), une tempête poussa le vaisseau de Lief Erikson sur la côte nord-est de l'Amérique, en l'an 999 ou 1000 A.D., pendant qu'il faisait voile du Groënland à la Norvège.

La nouvelle de la découverte d'Erikson porta Thorfinn Karlsefni, en 1003, à équiper, en Groënland, une expédition composée de trois vaisseaux avec 140 hommes, dans le but d'explorer et de coloniser les nouvelles terres. Ces entreprises menèrent à la découverte des régions qu'on appela Helluland (Labrador), Markland (Terreneuve ou la Nouvelle-Ecosse), et Vinland (un pays au climat tempéré, probablement situé plus au sud). La première rencontre des indigènes—les Skraelings—avec l'homme blanc est aussi brièvement décrite par les chroniqueurs contemporains. Ces descriptions ont permis de les identifier aux Esquimaux. Au XIIIe siècle, les colons scandinaves du sud-est du Groënland entrèrent en de continuels conflits armés avec leurs voisins esquimaux, qui finalement les exterminèrent ou les chassèrent hors de l'île.

Il est fort probable que, au cours du XVe siècle, même avant la découverte de l'Amérique centrale par Colomb, des explorateurs et des pêcheurs français aient souvent visité les côtes occidentales du Canada et rencontré des indigènes de la région. Aucune relation de leurs voyages n'est cependant parvenue à la postérité.

S'inspirant des théories révolutionnaires de Marco Polo et de Toscanelli, Christophe Colomb, vers la fin du XVe siècle, inaugura

l'époque des explorations vers l'Occident, par sa tentative d'atteindre les Indes par ce que l'on croyait être la voie courte et directe pour se rendre à Cathay (Chine) en traversant l'Atlantique. Le mouvement une fois commencé, les marins espagnols, portugais, français et anglais entreprirent aussi l'exploration des mers occidentales, à la recherche d'un passage conduisant à Cathay et aux Indes, dont les richesses fabuleuses tentaient leur cupidité. Les Portugais et les Espagnols confièrent leurs vaisseaux au Gulf-stream ou courant équatorial du Sud fluant vers l'Est, pendant que leurs voisins anglais et français parcouraient le courant équatorial du Nord, longeant les côtes d'Irlande, et allaient aborder aux rives du Labrador et de Terreneuve.

Méprenant ainsi l'Amérique pour l'Asie, d'abord, les Espagnols et les Portugais découvrirent les contours occidentaux de l'Amérique centrale et méridionale. Les Français et les Anglais, cherchant de leur côté le passage de l'Ouest, dirigèrent des expéditions vers le continent septentrional, et explorèrent, les premiers, le bassin du Saint-Laurent et des lacs, et, les seconds, la Baie d'Hudson et les mers arctiques.

La première relation authentique concernant une tribu indienne de l'Est est celle de Cartier. Ayant jeté l'ancre dans la Baie-des-Chaleurs, en 1534, il reçut la visite d'un nombre d'indigènes—probablement des Micmacs—qui parurent renseignés sur le caractère et les besoins des étrangers, avec qui ils voulaient troquer des peaux pour diverses bagatelles. Remontant le Saint-Laurent, en 1535, Cartier fit alliance avec une autre tribu algonquine, à l'endroit qu'occupe aujourd'hui Québec, et hiverna dans les environs. Malgré l'opposition de ses alliés algonquins, Cartier visita leurs ennemis les Mohawks, et fut ainsi probablement le premier homme blanc que vit une tribu iroquoise, dont le village le plus oriental était alors situé sur l'emplacement actuel de Montréal. L'importance des découvertes de Cartier restant incomprise, seuls des navires de pêcheurs et de marchands isolés sillonnèrent le Saint-Laurent durant les soixante ans qui suivirent.

Peu après l'exploration des abords de la Baie d'Hudson par les Cabot, Frobisher, Davis et Weymouth, il se produisait, dans la première décade du XVIe siècle, un renouveau d'enthousiasme pour la recherche du passage du nord-ouest aux mers occidentales. Au nom de la France, Champlain prit possession définitive, en 1608, de la vallée du Saint-Laurent, et établit un poste permanent et une colonie à Québec.

Ayant échoué dans la découverte du passage vers la Chine, les découvreurs et les pionniers français tournèrent bientôt leur attention vers le vaste champ d'aventures qui s'ouvrait devant eux. Par suite

de leur alliance avec les nations algonquines et huronnes, ils se trouvèrent immédiatement engagés dans une guerre pénible avec les Iroquois, guerre qui devait durer presque sans interruption pendant cent cinquante ans. D'autre part, et simultanément, les missionnaires les marchands de fourrures et les coureurs-de-bois entreprirent un envahissement pacifique des régions de l'intérieur. L'ère des relations constantes entre Européens et Indiens avait ainsi commencé. Dans l'intervalle, des marins anglais—Hudson, Button, Foxe et James—poursuivaient plus au nord la recherche du passage de l'Ouest, qui devait seulement aboutir au plus complet désappointement, après une période de 25 ans d'actives explorations dans la Baie d'Hudson, se terminant vers 1631. C'est seulement en 1668 que, sur les représentations de Chouart et de Radisson, les Anglais témoignèrent un nouvel intérêt à la Baie d'Hudson, mais cette fois pour les ressources imprévues de son commerce de fourrures avec les indigènes de la côte et de l'intérieur.

Le mode de vie des indigènes, demeurant à l'est des Montagnes-Rocheuses, subit de bonne heure une commotion et un dérangement profonds résultant de leurs étroites relations avec les compagnies de marchands anglais et français, et des querelles persistantes entre ces rivaux et leurs alliés. Les Indiens des lacs et de l'Ouest échangèrent leurs fourrures pour des articles de fabrication européenne. Ils faisaient d'abord la traite des pelleteries avec les Français ou avec les tribus intermédiaires, qui avaient l'habitude de faire des expéditions annuelles à Montréal et à Québec. Une proportion considérable du commerce des fourrures ayant plus tard pris la route d'Albany (N. Y.) au profit des marchands anglais, les Français, afin de maintenir leur prestige et d'obvier aux périls de la route laurentienne, établirent plusieurs forts et postes de traite au nord des grands lacs. La recrudescence d'activité du commerce des Anglais, due à l'établissement, vers 1668, de postes de traite permanents sur la côte sud-ouest de la Baie d'Hudson par la Compagnie de la Baie d'Hudson, induisit les Français à pénétrer plus avant dans l'intérieur, afin de trafiquer directement avec les Indiens, clients de l'organisation rivale. De la Vérendrye fut le premier qui atteignit les prairies du Nord-ouest, en 1733, et visita le pays des Sioux, des Assiniboines et des Cris des Plaines; et Legardeur de Saint-Pierre, en 1751, construisit un fort près des Montagnes-Rocheuses, à la source de la rivière Saskatchewan.

Après la conquête du Canada par l'Angleterre, les compagnies françaises avaient à peine cessé leurs opérations qu'une ère de luttes intenses entre les intérêts anglais rivaux—et d'une importance extrême pour les Indiens de l'Ouest—commença avec la création, en 1783-84,

de la Compagnie du Nord-Ouest. Les représentants de cette société établirent leurs quartiers à Montréal. Suivant les traces des explorateurs français dans l'Ouest, ils réussirent à s'emparer d'une large part du commerce des fourrures, jusque-là le monopole, en fait, de la Compagnie de la Baie d'Hudson. L'histoire des vingt-cinq années suivantes est, en partie, celle de l'occupation rapide de l'Ouest par les compagnies, de leur rivalité acharnée, de leur exploitation des Indiens et de l'érection de forts aux points stratégiques, jusqu'à leur fusion en 1821. Alexandre Henry et Alexandre Mackenzie, de la Compagnie du Nord-Ouest, et Samuel Hearne, de la Compagnie de la Baie d'Hudson, furent les premiers explorateurs des régions du Nord-ouest. Hearne poussa, par voie de terre, en 1787–90, jusqu'à la côte arctique et à la rivière Coppermine. Et Mackenzie, en 1787-90, découvrit la rivière Mackenzie, qu'il suivit jusqu'à son embouchure, et, en 1793, atteignit l'océan Pacifique, après avoir traversé les Montagnes-Rocheuses. Les relations détaillées que laissèrent ces explorateurs, concernant les nations algonquines, siouses et athapascanes, constituent une précieuse description de la civilisation et des conditions anciennes de ces indigènes.

Les premiers Européens qui vinrent en contact avec les Esquimaux de l'Alaska et les nombreuses tribus de la côte nord-ouest, dans la dernière partie du XVIII^e siècle, furent les circumnavigateurs et les corsaires russes, espagnols, anglais et français. Portant commission du tsar de Russie, en 1725 et 1735, Vitus Bering conduisit les premières expéditions transsibériennes aux côtes, jusque-là inconnues, du nord-ouest de l'Amérique. Et pour la première fois, en 1741-42, un de ses partis rencontra quelques Esquimaux hostiles de l'Alaska et des îles Aléoutiennes. Une nuée d'aventuriers, de proscrits et de corsaires russes s'abattit, durant cinquante ans, sur l'Alaska et la côte nord-ouest, alléchés par les énormes profits que procurait le massacre des animaux à fourrure de la côte. Afin d'accroître leur butin, ils réduisirent pratiquement les indigènes mécontents et rebelles à une espèce d'esclavage au moyen de méthodes inhumaines. En 1799, le tsar, ayant accordé à la compagnie de fourrures russe-américaine le monopole du commerce, les Russes tentèrent d'exclure systématiquement les étrangers et déclarèrent le Pacifique-nord une mer fermée russe. D'autre part, de leurs possessions de l'Amérique centrale, les Espagnols avaient, de bonne heure, envahi la côte occidentale américaine et aussi cherché à en bannir la concurrence étrangère. Contestant les privilèges exclusifs, réclamés par les découvreurs russes et espagnols de la côte nord-ouest, d'autres nations, cependant, entrèrent bientôt dans l'arène commerciale. Environ deux siècles après que Francis Drake

(1580) et Juan de Fuca (1590) eurent jeté l'ancre le long de la côte, au nord de la Californie, des circumnavigateurs anglais, français, et américains—Cook, La Pérouse, Vancouver, Portlock, Dixon, et autres—se frayèrent une route jusqu'à la côte nord-ouest. Après 1776, nombre d'aventuriers et de marins troquèrent avec les Indiens des ustensiles et des articles européens contre de précieuses cargaisons de fourrures. Vancouver, envoyé ostensiblement pour régler des querelles, prit possession au nom de l'Angleterre, en 1793-94, des territoires inoccupés sur la côte. Cette prise de possession s'affermit par l'occupation graduelle du territoire intérieur qui forme aujourd'hui la Colombie-Britannique, par les compagnies de fourrures anglaises, et par les explorations de leurs agents Mackenzie, Fraser et Thompson, les premiers hommes blancs qui aient visité le pays des tribus Salish et Athapascanes de l'intérieur.

L'établissement d'un poste de la Compagnie de la Baie d'Hudson à Victoria, C.-B., en 1843, ouvrit une ère nouvelle dans l'histoire de la Colombie-Britannique et des Indiens de la côte nord-ouest. A dater de cette époque, ces tribus furent en contact intime et continu avec les traiteurs anglais et les pionniers envahisseurs. Les derniers indigènes du Nord-ouest à se soumettre furent les Ahtena ou Tinneh, le groupe le plus septentrional des peuples Athapascans, qui occupent le bassin de la rivière Copper, dans l'Alaska. Nombre d'explorateurs russes et anglais furent massacrés, depuis 1791, pour s'être aventurés sur leurs territoires. Ce n'est qu'en 1884 que des blancs revinrent de leur pays pour raconter leurs aventures parmi les indigènes de la rivière Copper.

Avant d'étudier la nature et les résultats des relations entre les Indiens et les blancs, examinons ce qu'étaient les races indigènes, leurs groupements linguistiques, leur état de civilisation, leurs systèmes religieux et moral, leur organisation sociale, leurs arts utilitaires et esthétiques.

Au seul point de vue de la langue, les indigènes du Canada se trouvent partagés en neuf ou dix souches absolument indépendantes. Ces familles liguistiques sont celles: (1) des Esquimaux des régions arctiques, s'étendant du sud de l'Alaska au Labrador, (2) des Algonquins de l'Est et des Plaines, (3) des Iroquois des grands lacs, (4) des Sioux de l'Ouest, (5) des Athapascans ou Dénés occupant les vastes régions situées à l'est et à l'ouest des Montagnes-Rocheuses du Nord-ouest, (6) des Kootenai, maintenant fixés à l'intérieur de la Colombie-Britannique, (7) des Salish, du sud de la même province, (8) des Wakashes de la côte adjacente, (9) des Tlingit-Haida, du sud de l'Alaska et des îles de la Reine-Charlotte, et, en dernier lieu, (10)

des Chimesyan dont les tribus habitent les vallées des rivières Nass et Skeena.[1]

Ces grandes familles linguistiques possèdent à peu près toutes un plus ou moins grand nombre de dialectes. Par exemple, les Algonquins, en particulier, se divisent en deux groupes: ceux de l'Est et ceux de l'Ouest. Les dialectes algonquins de l'Est sont, d'abord, le micmac, le malécite, l'abénaquis, des provinces Maritimes; et ensuite, le mascopie, le montagnais, le cris, l'algonquin proprement dit, l'ottawa, l'ojibwa, des provinces de Québec, Ontario et Manitoba. Les Algonquins de l'Ouest sont les Pieds-noirs, qui se subdivisent en trois bandes, les Bloods, les Piegans et les Pieds-noirs proprement dits. Il serait trop long d'énumérer les dialectes de chaque langue-mère; cet exemple suffit.

Quant à leur mode d'existence, les Indiens du Canada étaient sédentaires, semi-sédentaires ou nomades. Les seuls peuples sédentaires et agriculteurs, vivant dans des villages et cultivant des céréales, étaient les Iroquois-Hurons des grands lacs, et, à un moindre degré, les bandes algonquines avoisinantes. Sont semi-sédentaires les Esquimaux et les nations de la côte nord-ouest, à savoir: les Tlingits, les Haida, les Taimshian, les Kwakiutl, les Nootka et les Salish. Leur subsistance provenant tour à tour des faunes marine et terrestre, ces peuples vivent, suivant les saisons, de pêche ou de chasse, soit dans leurs villages quasi-permanents, le long de la côte, soit dans les bois, à la recherche de gibier et de provisions. Quant aux Algonquins, aux Sioux et aux Athapascans, c'étaient des races essentiellement nomades, suivant dans leurs migrations le gibier et le poisson, dont dépendait principalement leur subsistance.

Correspondant à leur mode d'existence—sédentaire, semi-sédentaire ou nomade—les indigènes canadiens jouissaient jadis d'institutions sociales, religieuses et morales de genres variés et appropriés aux circonstances. Les nations sédentaires ou semi-sédentaires se caractérisaient par la complexité étonnante de leur organisation sociale et de leur gouvernement. Les nations iroquoises et huronnes, les tribus algonquines environnantes, et celles de la côte nord-ouest, se distinguaient par une organisation familiale et sociale d'un genre particulier. Tout individu appartient, encore aujourd'hui, chez elles, à un groupe d'apparentés exclusivement consanguins ou utérins. En d'autres termes, leurs liens de parenté se computent exclusivement ou en ligne maternelle ou en ligne paternelle, mais plus généralement

[1] Il est fort possible qu'une étude critique des langues Tlingit-Haida et Chimesyan, d'une part, et de celles des Wakashes et des Salish, d'autre part, finisse pra démontrer l'existence de deux souches linguistiques mères sur la côte nord-ouest, au lieu des quatre groupes indépendants qu'on a reconnus jusqu' ici.

en ligne maternelle. Chacun de ces groupes possède, en outre, un blason totémique qui caractérise emblématiquement son individualité. Cette transmission du blason, accomplie en perpétuité du côté de la mère, ou du côté du père, suivant les tribus, a fini par constituer des groupes très populeux d'apparentés, souvent disséminés sur de vastes territoires. Ainsi les Cinq-Nations iroquoises et les Hurons—comptant autrefois plus de trente mille âmes—ne reconnaissaient chez elles que dix ou douze grandes familles (clans), dont les plus importantes étaient celles de la Grande-Tortue, du Chevreuil, de l'Ours et du Loup. Les Tlingit, les Haida, les Tsimshian et les Heiltsuq de la côte nord-ouest, d'autre part, ne se partagaient qu'en peu de phratries ou groupes de parents, soit: ceux du Corbeau, du Loup, de l'Aigle, de l'Ours et du Guitina, lesquels comprenaient un certain nombre de clans. Or, le gouvernement de ces peuples était uniquement basé sur leur organisation familiale. Les biens communaux ou privés, les successions, le mariage, les transactions internationales ou domestiques étaient régis par des coutumes remarquablement complexes, dont les principes fondamentaux reposaient, d'abord sur l'autonomie primordiale du groupe d'apparentés, ensuite sur les alliances et compromis entre diverses familles (clans ou phratries).

Le système juridique de ces nations sédentaires était éminemment approprié à leur mode d'existence. Celui des tribus de la côte nord-ouest, communément désigné sous le nom de 'potlatch,' embrassait un grand nombre de transactions publiques et privées. Parmi ces transactions, au moins une dizaine d'espèces de contrats s'exécutaient devant des assemblées de témoins, formellement invités et récompensés, au cours d'un cérémonial rigoureux et élaboré.

L'organisation sociale et les coutumes des races nomades algonquines, siouses et athapascanes, par ailleurs, sont simples et compatibles à leur mode d'existence instable. Certaines sociétés ou fraternités importantes se sont toutefois développées parmi les Ojibwas et les Sioux de l'Ouest.

Les religions et les rituels des indigènes du Canada étaient plus ou moins complexes suivant que ceux-ci étaient sédentaires ou errants. Pratiquement toutes les tribus croyaient en des êtres surnaturels, sous la direction desquels s'opèrent les phénomènes naturels, ou même sociaux. Les cultes, toutefois, n'étaient pas nécessairement coordonnés aux croyances; et il arrivait fréquemment que des rituels s'empruntassent d'une tribu à une autre, indépendamment de leurs panthéons respectifs. Les êtres surnaturels qu'on trouve à peu près partout chez les Indiens sont ou personnels ou impersonnels. Ces derniers étaient des objets inanimés—des amulettes et des talismans—auxquels on attribuait, pour diverses raisons, des pouvoirs magiques.

Les êtres personnels, ou les divinités, tout nombreux qu'ils étaient, se rangeaient en deux classes distinctes: les grandes divinités tribales ou internationales, et les dieux domestiques. Quelques-uns des hauts dieux, comme le Tonnerre, le Soleil et la Lune, le 'Transformateur,' les Jumeaux créateurs, le grand Vieillard, étaient des personnalités héroïques ou divines, connues d'un grand nombre de peuplades en commun. Les dieux nationaux, domestiques et individuels, tout en étant moins universellement connus, étaient l'objet, de la part de leurs protégés, d'une vénération plus particulière, et, souvent, d'un culte formel. Ces êtres, ordinairement des monstres ou des animaux mythiques, étaient les protecteurs surnaturels des phratries, des clans, des familles, des fraternités, ou des individus. On leur donne souvent le nom de 'totems', 'manitous', 'snams', ou 'esprits gardiens'. Ainsi, chez les tribus de la côte nord-ouest, le Corbeau, le Loup, l'Aigle et l'Ours servaient à la fois de dieux domestiques et d'emblêmes héraldiques à leurs protégés et clients.

Quant aux arts utilitaires et esthétiques des indigènes, à défaut d'espace, il n'en peut être fait ici qu'une brève mention. Les arts utilitaires, subordonnés qu'ils sont aux besoins de la vie, avaient fait beaucoup plus de progrès que les arts esthétiques. Vivant la plus grande partie de leur vie dans les bois, le long des rivières ou près de la mer, les Indiens étaient des chasseurs, des pêcheurs et des canotiers d'expérience; si bien que, après la découverte, les compagnies de commerce de pelleteries comptèrent sur eux pour la recherche des fourrures. L'usage des métaux étant inconnu avant l'arrivée des Européens, les lances ou pointes de leurs instruments, et leur armes, étaient faites de pierre éclatée ou polie, d'os, d'ivoire ou de coquilles ciselés, ou de bois durci au feu. La fabrication de la poterie était cependant connue de plusieurs peuples canadiens, et était devenue chez les Hurons-iroquois un des arts les plus répandus. Leurs maisons de différentes sortes, leurs costumes, leurs instruments de voyage, tels que canots et raquettes, et, enfin, tout ce qui était indispensable à leur vie relativement simple avait atteint un degré de perfection et d'utilité qui s'est bien abaissé depuis la venue des blancs.

Les arts esthétiques, la sculpture en ronde-bosse ou en bas-relief, en particulier, les patrons décoratifs en '*appliqués*' de poils de porc-épic ou d'orignal, étaient particulièrement remarquables parmi les tribus de la côte nord-ouest et parmi les Esquimaux, et n'étaient pas inconnus parmi les autres tribus. La musique, la danse, la pantomime, les jeux de hasard, l'éloquence et la politique jouaient un rôle encore plus important chez les Indiens que chez nous, et excitaient souvent la surprise ou l'admiration des anciens voyageurs européens.

Qu'il suffise d'ajouter que, avant la découverte, la plupart des tribus indigènes du Canada jouissaient d'une existence paisible et heureuse. Les Esquimaux, encore aujourd'hui, paraissent être le peuple le plus heureux et le plus satisfait de la terre. Au milieu de vastes domaines, pourvus de chasses abondantes, ignorant les cupidités et la plupart des vices des Européens, possédant des institutions civiles et religieuses parfaitement appropriées à leur régime de vie, les Indiens eurent raison de voir en l'arrivée des envahisseurs blancs le plus grand des malheurs, et la fin prochaine de leur race.

III.

Considérons maintenant en peu de mot, d'abord la nature des relations entre les blancs et les indigènes du Canada, et, ensuite, le résultat de ces contacts sur les Indiens.

Les relations politiques, commerciales et sociales se sont établies et perpétuées dans des circonstances différentes et à des époques plus ou moins reculées, entre les races indigènes et diverses nations européennes. Les relations politiques et internationales présentent des aspects variés. Il n'y a guère lieu de s'arrêter ici sur les premières rencontres qui se produisirent entre les Esquimaux du Groënland, de la Baie d'Hudson et de l'Alaska, d'une part, et les Scandinaves, les Anglais et les Russes, de l'autre. Ces rencontres se caractérisèrent le plus souvent par des crimes, des hostilités et des massacres. Les alliances ou les guerres qui suivirent l'arrivée des rivaux français, danois et anglais sur le versant oriental de l'Amérique du Nord, offrent d'ailleurs plus d'intérêt. Cartier, en 1634-35, avait contracté des alliances passagères avec des tribus algonquines du fleuve Saint-Laurent et les Mohawks (Iroquois) de Montréal. Environ soixante-quinze ans plus tard, en 1608, Champlain prit possession de la vallée du Saint-Laurent à titre de premier occupant, se lia d'amitié avec les Hurons et les Algonquins, et prit part à trois de leurs campagnes contre leurs ennemis, les Iroquois. D'un autre côté, les Danois et les Anglais tour à tour s'emparèrent de la côte américaine voisine. Faisant alliance avec les Cinq-Nations iroquoises, ils leur procurèrent les armes à feu qui, dans la suite, contribuèrent à les rendre la terreur et le fléau de tous les Indiens de l'Est, et les exterminateurs des Hurons, des Eriés, des Neutres et des Algonquins. Les Français, continuellement harcelés par les Iroquois, entreprirent contre eux plusieurs campagnes militaires dont le succès fut douteux.

Les principes politiques des Français et des Anglais à l'égard des nations indiennes n'étaient pas identiques. Tandis que les Français se considéraient les maîtres absolus des territoires dont ils s'étaient

emparés en vertu du droit du premier occupant, les Anglais préféraient conclure avec les indigènes des traités par lesquels ils achetaient leurs domaines à un prix nominal. Grâce à leurs alliances guerrières avec les Indiens des grands lacs, et à leurs liens d'amitié avec eux, les Français parvinrent aisément à étendre leur territoire vers l'Ouest en établissant, avec la permission des peaux-rouges, une chaîne de forts pour protéger leur commerce de fourrures. Après la conquête du Canada, les Anglais se conformèrent aux principes politiques des Français à l'égard de leurs anciens alliés du Saint-Laurent et des lacs, et continuèrent à faire des traités avec les Indiens de l'Ouest. Les compagnies de la Baie d'Hudson et du Nord-Ouest, toutefois, ne se proposant que la traite des fourrures, ne soulevaient pas la question oiseuse de la possession territoriale des vastes domaines qu'elles exploitaient.

Quant aux indigènes de l'Alaska, de la côte nord-ouest et de la Colombie-Britannique, d'autres forces et principes entrèrent en jeu. Les Russes et les Espagnols, comme nous l'avons vu, abordèrent les premiers en ces régions. Faisant de l'Alaska leur pied-à-terre permanent, les Russes exploitèrent avec extravagance les ressources de la côte. Se servant des Esquimaux aléoutiens et des Tlingit comme de serfs ou d'esclaves, capturant leurs femmes pour les faire racheter contre des rançons de fourrures précieuses, ils s'en firent des ennemis redoutables. Une série de représailles et de massacres odieux fut d'ailleurs suivie d'une ère de compromis, où les Indiens et leurs conquérants s'accommodèrent d'un régime plus équitable. Les Espagnols, pendant ce temps, sillonnaient également les eaux du Pacifique, le long de la côte. Ne convoitant que l'or, ils ne voyaient qu'un profit négligeable dans le commerce des fourrures. Ce n'est qu'en passant qu'ils entrèrent en relations avec les peaux-rouges de la côte, qu'ils massacraient souvent pour les piller; ce qui provoqua dans la suite des vengeances sanglantes contre des commerçants d'autres nations. Quant aux navigateurs anglais et américains isolés, qui longeaient la côte nord-ouest vers la fin du XVIIIe siècle, ils ne s'occupaient que de leur commerce accidentel avec les Indiens. Ce n'est qu'à l'arrivée en Colombie-Britannique des Compagnies du Nord-Ouest et de la Baie d'Hudson, vers 1810, que les relations entre les blancs et les peaux-rouges devinrent plus suivies. Etablissant des forts de commerce, ils évitèrent comme toujours de soulever la question de possession territoriale, et se ménagèrent les services des indigènes, grâce à leurs méthodes opportunistes. Le principe politique de la Couronne britannique d'acheter les domaines indiens par des traités solennels ne s'applique pas à la Colombie-Britannique. A partir de 1849, on s'empara purement et simplement des territoires de l'île de Van-

couver et de la Colombie, sans indemniser les indigènes autrement qu'en leur attribuant, avec des restrictions, certaines réserves.

Le status légal des Indiens d'aujourd'hui vis-à-vis du gouvernement canadien n'est pas uniforme. Il convient de dire que ces variations sont dues aux transformations périodiques des principes dirigeant l'administration des affaires indiennes. A l'époque de la conquête, les indigènes du Bas-Canada et des Provinces maritimes vivaient déjà sur des réserves placées sous la tutelle des gouvernements locaux. On continua après la conquête et la Confédération ce régime d'administration antérieur. Quant aux peaux-rouges de l'Ouest et du Nord-ouest ils se virent graduellement contraints de céder la plus grande partie de leurs vastes domaines par des traités, en considération de certaines sommes versées sur le champ ou payables en annuités. Aujourd'hui, il ne leur reste plus que des réserves placées sous la surveillance du gouvernement, et où ils ne se suffisent pas généralement à eux-mêmes. Quant aux Esquimaux et aux Indiens de l'extrême Nord, leur éloignement même les a protégés jusqu'à un certain point contre les conséquences de l'envahissement; et leurs contrées, appauvries de leurs ressources premières, ne leur ont pas encore été enlevées.

L'administration des affaires indiennes, avant de tomber aux mains du gouvernement fédéral du Canada, en 1867, avait passé par plusieurs phases. Le commissariat des Cinq-Nations, dans les colonies anglaises du Sud, confié, en 1744, à Sir William Johnson, élargit ses opérations, après la conquête, et s'occupa des peaux-rouges du Canada.

La proclamation de 1763 divisait pratiquement les domaines des Indiens en deux groupes: les réserves inaliénables de l'Est, et les territoires libres de l'Ouest et du Nord. De 1816 à 1830, les affaires indiennes du Nord-ouest furent régies par un commandant militaire. En 1830, elles passèrent aux soins de deux corps administratifs principaux, ceux des Haut et Bas-Canadas. La surveillance des indigènes des Provinces maritimes et de la Colombie-Britannique restaient sous la juridiction de bureaux locaux. La centralisation définitive de l'administration des Indiens s'opéra en 1867, lors de la Confédération, et fut remise au " Département des affaires des Sauvages ". Depuis ce temps, la plupart des peaux-rouges vivent sur des réserves, à l'exception des Esquimaux, de leurs voisins de l'extrême Nord, et des quelques Wyandots affranchis d'Anderdon (Ontario).

Un Indien demeurant sur une réserve est soumis à des restrictions légales. Privé des droits de citoyen britannique tant qu'il demeure sur une réserve, il peut faire commerce et s'affranchir s'il

élit domicile ailleurs. Un changement de principe radical a été introduit par une loi fédérale de 1911. Jusque-là, les Indiens ne pouvaient être troublés dans la possession paisible de leurs réserves, s'ils ne consentaient à les céder. L'amendement de 1911, toutefois, permet, grâce à certaines procédures, de s'emparer de celles-ci sans consulter les Indiens; ce qui rend très précaire la possession réservée de tout domaine dont la valeur excite la convoitise des spéculateurs étrangers.

Afin de provoquer des progrès économiques, chez les Indiens de l'Ouest, le Département des affaires des Sauvages emploie certains revenus annuels de leurs protégés à leur apprendre à cultiver la terre et à élever des bestiaux. Les Indiens des autres parties du Canada sont moins favorisés à cet égard. Le désir d'obliger les peaux-rouges à se conformer à nos manières et à nos coutumes a dernièrement poussé l'administration fédérale à leur imposer des règlements défendant la célébration de certains rites traditionnels. Ainsi, l'ancien système juridique des indigènes de la Colombie-Britannique, le ' potlatch ', a dernièrement été prohibé comme " offense criminelle." Et, cette année même, on a défendu aux peaux-rouges des Plaines de prendre part à toute danse indienne, en dehors de leur propre réserve.

IV.

Les relations commerciales entre les Indiens et les blancs se résument peu de choses: d'abord et surtout, la traite des pelleteries et, à défaut de la traite, la vente d'objets de manufacture indienne, ou le louage de services personnels. Le Canada a longtemps été le pays des fourrures par excellence. La colonisation, l'agriculture et les mines n'y comptaient guère avant une époque très rapprochée. Sous le régime français, les diverses compagnies qui se sont intéressées tour à tour au commerce des fourrures, jouèrent un rôle prépondérant dans la colonie, et les colons y étaient seulement tolérés. Les compagnies anglaises, russes ou américaines, en particulier celles de la Baie d'Hudson et du Nord-Ouest, eurent pour les fins de leur industrie la jouissance exclusive des immenses territoires des peaux-rouges. Tout colon ou commerçant indépendant en était chassé sans merci.

Or, les Indiens étant d'habiles chasseurs et se prêtant naturellement au troc des peaux vertes contre des objets européens, devinrent volontiers les fournisseurs des grandes compagnies. Dans les premiers temps, la traite se faisait exclusivement aux postes français du Saint-Laurent, ou anglais d'Albany et de la Baie d'Hudson. Poussées par la concurrence, cependant, les compagnies rivales, fran-

çaises et anglaises, d'abord, et, ensuite, celles de la Baie d'Hudson et du Nord-Ouest, pénètrèrent dans l'intérieur pour augmenter leur commerce. La lutte acrimonieuse que se déclarèrent ces dernières, de 1783 à 1820, amena les marchands rivaux à explorer l'Amérique d'une rive à l'autre, et à établir des forts de commerce à tous les points stratégiques, pour faciliter la traite. Les peaux-rouges, de leur côté, se rendaient annuellement en caravanes à ces postes, échangeaient leurs ballots de fourrures contre des ustensiles, des couvertes, des armes, de la poudre, des bagatelles, et surtout, quand ils pouvaient se le procurer, du rhum. Les profits réalisés par les Indiens au cours de ces échanges ne correspondaient pas à ceux des compagnies. Celles-ci devinrent, en fait, extrêmement riches, tandis que les hommes-des-bois retournaient chaque année à leurs domaines, appauvris et démoralisés. Et, qui plus est, les marchands établirent un système de prêt en vertu duquel ils donnaient des avances à leurs clients, à charge de les rembourser en espèces l'année suivante. Le côté le plus pitoyable de ce commerce se révélait quand le prix passionnément convoité par l'Indien, le rhum, lui était accordé. Il donnait de bon gré tout son avoir pour quelques mesures d'eau-de-vie. Et son ivresse était suivie d'horribles orgies, inévitablement terminées dans le meurtre. Les marins et commerçants isolés qui naviguèrent de bonne heure le long de la côte nord-ouest n'avaient pas même la réserve de leurs confrères de l'intérieur. Le rhum frelaté qu'ils donnaient ordinairement à leurs clients de passage les rendait féroces et minait rapidement leur vie. L'équipage du capitaine Meares, hivernant vers 1790 près des îles de la Reine-Charlotte, périt en grande partie à cause de ses distributions indiscrètes du rhum destiné à la traite. Il ne faut pas croire, cependant, que ce commerce immoral et inhumain fut toujours sans frein. Au temps de la colonie française, le pouvoir religieux s'opposa souvent, et d'une manière véhémente, au commerce de l'eau-de-vie parmi les Indiens, et les évêques eurent des querelles avec les gouverneurs à ce sujet. Les marchands d'Albany, de leur côté, n'étaient pas très scrupuleux. Quant à la Compagnie de la Baie d'Hudson, ses directeurs comprirent de bonne heure les désavantages réels et les dangers de cet abus, et le prohibèrent. L'entrée en scène, toutefois, de compagnies rivales, causa un changement radical dans les méthodes admises de commerce. Désirant à tout prix se procurer les fourrures, et afin de devancer la concurrence, certaines corporations eurent un recours constant, de 1783 à 1821, au troc du rhum. L'eau-de-vie, à l'égard du peau-rouge, était le "Sésame, ouvre-toi". On pouvait toujours le dépouiller de ses biens à ce prix. La politique étroite de dénigrement et de duplicité que ces

commerçants pratiquèrent les uns contre les autres atteignit de tels excès qu'une guerre indienne, sur le point d'éclater vers 1810, ne fut détournée que par une épidémie affreuse de petite vérole, qui désorganisa temporairement le commerce. Les compagnies rivales, fédérées l'une à l'autre en 1821, interdirent l'usage de l'eau-de-vie comme article de traite. Et la Compagnie de la Baie d'Hudson n'a d'ailleurs pas abandonné depuis cette sage règle de conduite.

A mesure que la destruction ou l'appauvrissement des chasses du gibier à fourrure s'est accompli, les marchands ont graduellement délaissé les peaux-rouges. Aujourd'hui la traite des pelleteries ne se continue que dans les territoires encore déserts du nord et du nord-ouest.

Les relations commerciales, de nos jours, entre les peaux-rouges, les métis et les Canadiens, sont de nature différente. Quand les réserves indiennes ne fournissent pas à leurs habitants la piètre subsistance dont ils s'accommodent, les Indiens fabriquent des paniers, des mocassins, des raquettes et d'autres objets dont ils font commerce. D'autres, particulièrement en Colombie-Britannique, louent leurs services personnels et deviennent guides, ouvriers ou manœuvres, à l'emploi de diverses industries. Le cas ne manque pas, enfin, où la misère et le dénûment déciment les rangs déjà éclaircis de ceux qui ont eu le malheur de survivre à leur civilisation.

Le caractère des relations sociales entre les peaux-rouges et leurs maîtres ne fut pas toujours à la gloire des chrétiens. Les anciens missionnaires français entreprirent avec zèle l'évangilisation des infidèles. Peu nombreux et, d'ailleurs, se trouvant en présence de difficultés alors insurmontables, ils se réussirent point à leur gré à fonder l'œuvre magnifique de leurs rêves. Le rôle des anciennes missions protestantes, d'autre part, est infime. Les seules ouailles chrétiennes des missionnaires, au commencement du XIXe siècle, ne dépassaient pas le nombre de quelques milliers, à savoir: les métis Mohawks (ou "Iroquois priants") et Hurons de Caughnawaga, Saint-Régis, Oka et Lorette, Québec; les Micmacs des Provinces maritimes, et les quelques métis Abénaquis et Malécites de la province de Québec. L'œuvre des missionnaires n'a atteint des proportions considérables qu'assez tard, au XIXe siècle. Et, aujourd'hui, les oblats, les jésuites et un certain nombre de missionnaires indépendants, catholiques et protestants, ont réussi à évangéliser, au moins superficiellement, un nombre assez considérable d'Indiens du Nord et de l'Ouest. Le missionnaire ayant été le seul représentant de l'altruisme européen et de la charité chrétienne, il est malheureux que son œuvre n'ait pas atteint, dès les commencements, des proportions plus grandes. Quant aux contacts individuels entre les peaux-

rouges et les coureurs-de-bois, les commerçants, leurs commis, les pionniers, et enfin les baleiniers, parmi les Esquimaux, ils ne furent pas marqués d'un très haut idéal. Là surtout où les missionnaires n'avaient pas d'influence, la licence sexuelle a été de tout temps la règle, et la prostitution est devenue un commerce sur la côte nord-ouest. Citons ici les remarques écrites du Fort-Douglas, en 1818, par Mgr Provencher, premier évêque catholique du nord-ouest: "On peut dire sans hésiter que le commerce des blancs, au lieu de conduire les peaux-rouges au christianisme, n'a fait que les en éloigner. Et voici pourquoi: les blancs ont ruiné les principes moraux des Indiens par l'eau-de-vie, dont ceux-ci sont extrêmement avides. Ils leur ont, de plus, enseigné la débauche par leur mauvais exemple. La plupart des employés (des compagnies) ont des enfants de femmes qu'ils envoient ensuite au premier venu . . . Tous les commis et bourgeois ont des "squaws" et, ce qui pis est, ils ne font pas plus de cas des enfants nés de ces prétendus mariages que s'ils n'avaient pas d'âmes."[1]

L'inventaire des résultats du contact entre les blancs et les Indiens est maintenant facile à dresser. A l'époque de la découverte, aucune partie de ce qui est aujourd'hui le Canada n'était vacante, sauf les régions centrales arctiques. Ces vastes territoires, alors foisonnant de gibier, appartenaient divisément aux Indiens par droit d'héritage ou de conquête. Leur existence paisible et ordinairement heureuse n'était pas généralement troublée par les cupidités et les vices "décadents" que leurs envahisseurs semèrent à profusion parmi eux. Ils possédaient des civilisations, des systèmes religieux, moraux et sociaux admirablement conformes aux nécessités de leur mode de vie, nomade ou sédentaire. Tout cela a maintenant été changé. Les réserves souvent rocailleuses qu'on a imposées à la plupart des Indiens ont, depuis, été maintes fois rognées à leur désavantage. La possession de ce qui leur reste, même lorsqu'elle est enviable, est, depuis 1911, devenue précaire, et peut leur être enlevée sans leur consentement, dans certaines circonstances. Appauvris, démoralisés, on ne leur a pas même laissé un vestige de leur indépendance et de leur dignité naturelles; et à ceux qui n'ont pas encore été entièrement assimilés, on impose souvent des règlements qui leur interdisent la pratique d'anciennes coutumes auxquelles ils tiennent encore. Et, fréquemment, des délégations de chefs indiens, maintenant dénués d'autorité, viennent à Ottawa intercéder auprès des agents du gouvernement fédéral, ou plaider la cause de leurs nations. Quant à leurs arts utilitaires et esthétiques, et à leurs institutions sociales et

[1] Traduit de l'anglais du Rev. A. C. Morice, dans *Canada and its Provinces*, vol. II, p. 122.

religieuses, là où elles n'ont pas entièrement disparu, elles n'existent plus guère que dans la mémoire de leurs anciens, ou à l'état de vestige. Un ethnographe disait dernièrement à ce sujet: "Quant à l'étude (ethnographique) des Indiens, il est maintenant midi moins cinq;" c'est-à-dire qu'il est presque trop tard pour l'entreprendre. Il est certain qu'avant un siècle on ne connaîtra plus le peau-rouge que dans les livres.

Jetons maintenant un coup d'œil sur les statistiques concernant la population indienne.

Il y avait au Canada, en 1910, à peu près 110,000 peaux-rouges ou métis, partagés entre les provinces, comme suit: 25,000 en Colombie-Britannique, 22,565 dans l'Ontario, 16,000 dans les Territoires du Nord-Ouest, 11,874 dans le Québec, 9,155 dans l'Alberta, 8,990 dans la Saskatchewan, et 12,908 au Yukon, au Manitoba, et dans les Provinces maritimes. Au point de vue des groupements linguistiques, cette population est autrement répartie, à savoir: à peu près 50,000 Indiens de dialectes algonquins, soit 15,000 Cris, 15,000 Ojibwas, et 2,400 Pieds-noirs; environ 11,000 Iroquois, 1,471 Sioux-Assiniboines, 16,100 Athapascans, 10,264 Salish, 553 Kootenai, 4,150 Wakashes (Kwakiutl-Nootka), 4,341 Chimmesyan, 900 Haida, et 7,680 Esquimaux.

Ces chiffres ne constituent qu'une faible fraction de ce qu'était la population indienne avant la découverte, laquelle atteignait probablement un million d'âmes. Plusieurs nations, ou tribus, de différentes souches linguistiques ont été complètement anéanties depuis l'arrivée des Européens. D'autres ne sont plus représentées que par un petit nombre de métis. Les caractéristiques de race de la plupart, enfin, se sont plus ou moins altérées par leur avilissement et leur démoralisation, d'une part, et, de l'autre, par le mélange d'un courant considérable de sang européen. Ainsi ont complètement disparu: les Béothuks, de Terreneuve, les anciens Adirondaks, de la province de Québec et des frontières, deux peuples de dialectes algonquins. Tandis que les Eriés, les Neutres, et d'autres nations sédentaires iroquoises d'Ontario, ont été détruites peu après 1650, il ne reste plus que quelques centaines de métis Hurons-Wyandots, une nation iroquoise d'Ontario dont la population s'élevait, vers 1615, au chiffre de 20,000 à 30,000 âmes. Les Abénaquis, les Malécites, les Ottawas et les Algonquins proprement dits, appartenant à divers dialectes algonquins, ne comptent plus dans leurs rangs que quelques centaines de métis, souvent au teint blanc. De tous les autres, les indigènes de la côte nord-ouest sont ceux qui ont le plus souffert des débauches européennes. Les Haida, des îles de la Reine-Charlotte, ont été encore plus éprouvés que leurs

voisins, sur ce point. Leur population, déjà très réduite en 1840, était alors de 8,328. Tombés au chiffre de 600, en 1895, ils sont maintenant à peu près 900, dont un certain nombre de métis.

Les causes de cette décadence de la race sont multiples. Voici, en un mot, les principales: le rhum, les épidémies, la débauche, les massacres, et, enfin, la misère. Des maladies épidémiques, causant des ravages bien plus terribles parmi eux que parmi les blancs, ont été introduites par ces derniers chez les Indiens. Ainsi, la petite vérole et la rougeole ont à elles seules maintes fois réduit leur population de plus de moitié. La syphilis, la gonorrhée, la tuberculose, les fièvres intermittentes, le *trachoma*, qui sont pour la plupart des maladies européennes, font encore des grands ravages parmi eux.

Il ne nous reste plus maintenant qu'à terminer par une parabole indienne[1], résumant la philosophie du peau-rouge à l'égard de son envahisseur: " Au commencement, l'homme blanc s'approcha de l'Indien qui était assis sur un billot de bois. L'Indien étant à un bout du billot, le blanc s'approcha de lui et lui dit:—" Assieds-toi plus loin ! " L'étranger s'assit alors à côté de l'Indien. Mais il commença aussitôt à le pousser en répétant:—" Assieds-toi encore plus loin, encore plus loin ! " L'Indien, à la fin, se trouva tout-à-fait à l'autre bout du billot. Alors le blanc s'écria:—" Tout ce siège est à moi ! "

C.-M. BARBEAU.

[1] Recueillie, en 1911, à Anderdon, comté d'Essex, des lèvres d'une métisse huronne, Mary McKee.

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The Loyalist Settlements on the Gaspé Peninsula.

By PROF. WILBUR H. SIEBERT of The Ohio State University.

(Presented by W. D. LESUEUR, F.R.S.C.)

(Read May 27, 1914.)

In his efforts at the close of the Revolution to find suitable places for the settlement of those Loyalists who had taken refuge in Lower Canada, Governor Haldimand sent Captain Justus Sherwood, a trusted refugee from Vermont, to view the region round the northern side of the Bay of Chaleurs. This region is part of the Gaspé Peninsula, which forms the eastern extremity of the Province of Quebec, between the Gulf of St. Lawrence on the north and Chaleurs Bay on the south. The eastern end of the peninsula is deeply indented by Gaspé Bay, after which was named the administrative district that included most of the peninsula and therewith the scattered, little settlements of the French on its several shores.

Captain Sherwood left Quebec, May 29, 1783, in the treasury brig *St. Peter*, with his family, and bearing a letter of introduction from Haldimand to Captain Hugh O'Hara at Gaspé Bay. The letter stated that Sherwood's mission was to seek a location for a settlement on the Bay of Chaleurs, and directed that everything in the way of information and assistance be supplied him.[1] On June 7 our explorer reached his destination and landed his family at Captain O'Hara's, where he was well received. In his journal of this expedition, which is still preserved among Haldimand's papers, Sherwood tells us that O'Hara showed himself very ready to serve the distressed Loyalists, assisted him in the exploration of the country at Gaspé, and accompanied him on his journey to Chaleurs Bay. Sherwood's observations were extended to the situation, soil, climate, and products of this region. Concerning the first named district Sherwood reported that there was a quantity of level land of good soil and sparsely tim-

[1] Second Report, Bureau of Archives, Ont., Pt. II, 957; Haldimand Papers, B. 178, p. 197; B. 202, p. 142.

bered on the north and south arms of Gaspé Bay, the amount on each being sufficient for the sustenance of forty or fifty families. He also found an equal quantity on the River St. John, which empties into the bay, a locality which he described as a very pleasant place for about forty inhabitants, who would find the river abounding with salmon and the bay well supplied with codfish, eels, lobsters and other fish. Point St. Peter he recommended as a site for a fishery, but remarked that the soil there was not fit for cultivation, while Point Percé possessed the advantage in this respect, affording two hundred acres of good level land fronting on the sea. Here there was room for a town of about a hundred houses, with space sufficient for fishing grounds, gardens, and other conveniences.

On June 16 Sherwood and O'Hara arrived at Pabos, where they noted the fine harbor with its narrow entrance "somewhat difficult for large vessels," and they noted also the fertility of the soil. The neighboring rivers were discovered to be stocked with trout and salmon and the mountains covered with timber in abundance. The prime value of the place lay, however, Sherwood judged, in its fine situation for a fishery. Next to Pabos, Paspebiac was recommended for its advantages for fishing and trade and for its soil which, the prospector declared, was the best he had seen in the gulf. The visitors found Bonaventure, with its fine harbor and wide extent of level country, already thickly populated; they formed a good opinion of the region on the Cascapedia River where the town of New Richmond was soon to spring up, and also of the land on the Grande Nouvelle. Sherwood praised the climate of Chaleurs Bay, and estimated that 1,500 families might immediately settle at the various places visited, namely, Pabos, Paspebiac, Bonaventure, Cascapedia, and Nouvelle, while at least two hundred more might be advantageously settled from Percé to Gaspé. He suggested that intending colonists should be supplied with stock, farming tools, and other things necessary; but he protested against the practices of a few designing traders, who kept the inhabitants in debt.

The last stage of the Captain's journey of inspection took him to the River Miramichi to the south of the Bay of Chaleurs. He entered this river on July 1, and described it as a fine stream abounding in various kinds of fish and navigable for vessels of a hundred tons up to its fork, above which there was good land sufficient for 500 families. By July 14 Captain Sherwood and his companion were back at Gaspé. Thence he departed with his family for Quebec on the 20th, arriving at the latter place on August 12th. His report to Haldimand was written less than a fortnight afterward.[1]

[1] Haldimand Papers, B. 169, pp. 5, ff.

The favorable character of this report led the Governor General to encourage Loyalists to settle on the Bay of Chaleurs, among the various districts that were then being opened to their occupation. Accordingly, towards the close of February, 1784, and again early in May, information was published in Quebec and sent to the several localities where the refugees were quartered that those desiring to take up lands in the region indicated should hand in their names and prepare to embark on the shortest notice. Word of the time and place of departure was to be announced later. The official correspondence of the period shows that the first embarkation was to take place at Quebec about May 24, although it did not actually occur until June 9. The response on the part of the refugees was ludicrously disproportionate to the extensive area mapped out for colonization in Sherwood's report. On the date named only three hundred and fifteen persons sailed in the brigs *St. Peter*, and *Polly*, the snow *Liberty*, the hoy *St. Johns*, and the four whale boats that completed the convoy. Of the passengers one hundred and twenty-nine were men, fifty-two, women, and one hundred and thirty-two, children. They went provisioned from the first of June to the last of August. On July 11 thirty-one men of the late 84th Regiment departed for the same destination, for the purpose of establishing a fishing settlement; on July 31 thirty-six persons followed with stores and provisions; on September 10, three men, and on November 8, twenty-one persons, with stores and provisions. According to this enumeration of the settlers going to the District of Gaspé, the total was only four hundred and six.[1]

The business of assigning lands to these settlers was entrusted to Nicholas Cox, lieutenant governor of the District. On June 18 Cox was at Percé, where he met the brig *St. Peter* and her passengers, evidently the first to arrive. At the end of the week the Loyalists proceeded to Paspebiac, where they were sent ashore to view the land, but—according to the Lieutenant Governor—"could agree to nothing." On Cox's recommendation Bonaventure was next visited, because it afforded a convenient landing-place, a quantity of supplies, and a shelter for the women and children. Attracted by the improvements of the Acadian inhabitants of the neighborhood, the Loyalists were not above proposing to deprive these people of their homesteads in order to satisfy at a stroke their own needs; but when this was declared impossible, they decided to return to Little Paspebiac, which the Lieutenant Governor considered the best site for a town. Matters now went forward rapidly: the early days of July found

[1] Haldimand, Papers B. 222, pp. 83, 84; B. 63, pp. 263, 285, 289, 294; B. 168, pp. 30-35; B. 64, pp. 41, 238.

O'Hara occupied in laying out the Township of Paspebiac, and George Geddes similarly occupied at some other point not designated. Already the refugees with O'Hara had planted their potatoes, and were petitioning for three months' provisions in addition to what they had brought with them, besides requesting a supply of boards, nails, seines, etc. A month later they had drawn their lots in the new township. As Paspebiac was to be a fishery, it was laid out in the form of a parallelogram, so as to include the beach and adjoining marsh; and provision was made for a reservation in the rear, partly to preserve a supply of timber, and partly to protect from molestation a score of families who had been living there for some years.[1]

Some of the disbanded soldiers among the new settlers had already begun to give trouble, and Cox suggested to Haldimand the appointment of a sheriff and several justices of the peace to maintain order and administer the law. Another source of disturbance to the new settlements was a party of American fishermen who, arriving in four vessels early in July, disembarked at Point St. Peter, Bonaventure Island, and Bonaventure, and there erected their fishing stages. Cox at once reported this intrusion to the government at Quebec, and received instructions to warn the trespassers off immediately and give them notice that the matter had been communicated to the British admiral stationed at Halifax. By the vessel bringing these instructions Governor Haldimand forwarded a hundred stands of arms with ammunition, besides other supplies. The arrival of these bounties was acknowledged by Cox in a letter of August 25, in which he expressed his belief that the Americans would not leave the coast unless forced to do so.[2]

The same letter bore testimony to the progress of the settlement at Paspebiac, for it reported that the refugees there were cheerfully occupied in building their homes and were becoming more and more pleased with their lands. Moreover, a memorial accompanied the letter, signed by Thomas Pryce Jones, Captain Azariah Pritchard, and other Loyalists, asking permission to erect a grist-mill for the benefit of the settlement. An unsigned memorandum, which was written a few days later than Cox's letter, presents the busy scene of men, women, and children all engaged in clearing their lots and putting up their abodes, and predicts that in eighteen months, when their garden produce and crops are gathered, they will need no further assistance. The writer adds enthusiastically that it is the best country for a poor man that he has ever seen, on account of the great quantity of fish, game, and timber, and the fertility of the soil. Even small

[1] Haldimand Papers, B. 202, pp. 186, 164, 196.

[2] Ibid., B. 202, p. 168; B. 64, pp. 109, 112-114; B. 202, pp. 204, 195.

plots, he continues, worked by the fishermen in the most slovenly manner, produce exceedingly good wheat, peas, potatoes, flax, etc., and the industrious are always sure of a good market.[1]

In settling the Loyalists and in distributing their provisions, clothing, and implements, Captain Law had rendered important services, which were highly appreciated by Lieutenant Governor Cox. Moreover, the latter thought that the new settlements needed special supervision, and recommended Law as a suitable person to exercise this function over them. Haldimand acted on the suggestion and, November 2, 1783, appointed Captain Law as superintendent in the District of Gaspé, with authority in all matters pertaining to the Loyalists. He also authorized Cox to commission him as justice of the peace and Thomas Mann as sheriff.[2]

Meanwhile, the colony at Paspebiac had spread to the lands contiguous to the first township surveyed by Captain O'Hara, and some of the refugees had settled at Gaspé, where they founded Douglastown. In both localities fishing became one of the chief occupations, as shown by the official report of November 10, 1784. This report stated that during the previous months the new settlers at Gaspé and the Bay of Chaleurs had exported 25,500 quintals of dried codfish.[3] At the close of June, 1785, O'Hara reported from the former place that the catch had been good up to that time, and that the Loyalists of both his neighborhood and the Bay of Chaleurs were improving their lands "in spite of some restless spirits among them." He called attention to the inconvenience to which vessels trading in Chaleurs Bay were put by having first to enter and clear at Gaspé, and enclosed a memorial asking a change. The change contemplated was the establishment of a customs-house, of which O'Hara wished to become collector. In another letter, dated September 12, he mentioned that Cox had transferred the seat of government from Percé to the Bay of Chaleurs.[4]

We are able to get some idea of the distribution of the Loyalists in the region whose newly acquired importance was thus recognized by Cox from the register of inhabitants which that official prepared in 1786. From its pages we find that three had taken up lots at Port Daniel, sixteen, at Hopetown, nine, in the Township of New Lake, seventeen, in the Township of Cox's Lakes, and eighty-five in the

[1] Haldimand Papers, B. 202, p. 209.

[2] Ibid., B. 64, pp. 379, 380; B. 202, p. 204; B. 64, pp. 100, 112-114, 379, 380.

[3] Ibid., B. 202, pp. 196, 218; LeMoine, Chronicles of the St. Lawrence, 13; Haldimand Papers, Q 24-1, p. 61.

[4] Haldimand Papers, B. 202, pp. 218, 222.

Township of Paspebiac, including Cox himself.[1] The register also shows that most of these settlers were farmers and fishermen, although there was a sprinkling of artificers and tradesmen. Light on the previous condition of these people is derived from their testimony before the commissioners of Loyalist claims in 1786 and 1787. From this source it appears that some of them had been persons of property in Albany and Charlotte counties, New York, at the outbreak of the Revolution, had joined Burgoyne's expedition down the Hudson and later served in various Loyalist regiments, including Jessup's, Peters' and Rogers' corps, and the King's and Butler's Rangers. At the close of hostilities a few of these provincials were quartered at Machiche until they were sent to Chaleurs Bay, where a group of them took part in settling New Carlisle.[2] The families of several other refugees joined the small settlement of French Canadians at New Richmond near the head of Cascapediac Bay, among these being Captain Azariah Pritchard and his household.[3] As Pritchard was one of the most notable Loyalists in the Gaspé Peninsula, it may not be out of place to say something concerning his record. He was one of a number of Connecticut men—among them, his father and brother—who adhered to the cause of the Crown. During the opening months of the Revolution he carried on operations at Milford, in southwestern Connecticut, assisting not less than one hundred and sixty men across the sound to Long Island. In 1777 he was tried by court-martial at New Haven for conveying intelligence to the British, and was acquitted, he tells us, by "bribing the presentor." He then made his escape to Canada, and for three years served as a guide on the eastern side of Lake Champlain, after which he raised a company for the King's Rangers, and although commissioned as a captain continued in the secret service until the close of the war.[4] With other Loyalists he now undertook to found a settlement at Mississquoi Bay, near the northern boundary of Vermont, but finding Haldimand unalterably opposed to the plan, decided to settle at the Bay of Chaleurs along with those he might induce to join him. As remarked above, he first located at New Richmond, but later, apparently, drew several lots at Paspebiac, and probably settled there. His military services were rewarded by a grant of half-pay as captain, which he is said to have received until his death in 1827. "He was to the last," says LeMoine,"

[1] Bundle, "L. C., Administration, 1781-1783." (In the Dominion Archives at Ottawa.)

[2] Second Report, Bureau of Archives, Ont., Pt. I, 152, 328-331, 335-338, 344, 345, 350; Pt. II, 923, 1063.

[3] LeMoine, Chronicles of the St. Lawrence, 85.

[4] Second Report, Bureau of Archives, Ont., Pt. I, 349.

"a stout, daring old man."[1] In 1877 when the writer just quoted visited the Gaspé Peninsula, he found there numerous descendants of the American Loyalists, all industriously employed as fishermen.[2]

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[1] Bundle, "L. C., Administration, 1781-1783" (In the Dominion Archives at Ottawa.)

[2] LeMoine, Chronicles of the St. Lawrence, 13.

The Temporary Settlement of Loyalists at Machiche, P.Q.

By PROF. WILBUR H. SIEBERT of The Ohio State University.

(Presented by W. D. LESUEUR, F.R.S.C.)

(Read May 27, 1914.)

The flight of Loyalists from the Northern colonies into the Province of Quebec during the Revolution was not confined to those able to bear arms: women and children and old men accompanied, or soon followed, the more vigorous members of their families. By the fall of 1778 such refugees were arriving in considerable numbers at the various posts below Lake Champlain, even as far north as Machiche (now Yamachiche) at the western end of Lake St. Peter. Conrad Gugy, seignior of the Parish of Machiche, who was a justice of the peace and a member of the King's council of the province, reported the arrival of such a group to Governor Haldimand in the middle of September of the year named, and wrote that he proposed to lodge them in his neighbourhood "to the end of having an eye upon them." He described the party as consisting of women and children, besides some officers, a dozen men who might be employed as artisans, and one Adams who claimed to have been a schoolmaster in the colonies and now asked for employment in the same capacity in the locality to which he had come.[1]

The idea of lodging the Loyalists under proper supervision at once recommended itself to Haldimand, especially as he had confidence in Gugy, a fellow-Swiss who had been his secretary at Three Rivers a dozen years before.[2] The need of succoring these people was already apparent, and the Governor General wished to separate them from the inhabitants as a precautionary measure. He accordingly transmitted his recommendations to his former secretary, who soon selected a site upon which to settle the refugees, and procured a large garden plot and pasture for fifty cows as part of the establishment. The letter containing the formal authorization of these arrangements and ordering the erection of the necessary houses for the accommodation of the Loyalists was issued from Sorel, October 6, 1778, where Haldimand then happened to be. It also empowered Gugy to lay down regulations for maintaining order among his wards and requiring

[1] Haldimand Papers, B. 164, pp. 1, 2.

[2] McIlwraith, Sir Frederick Haldimand, 62, 254.

their services, under penalty of being deprived of the allowance of provisions which they would otherwise receive, and of all other benefits, for such time as he might decide. The Seignior was to have the power of proceeding as a magistrate against any of the present number or of later accessions who should be guilty of "excessive refractoriness."[1]

And, indeed, some of the Loyalists at Machiche were not amiable people: Gugy was already finding it difficult to please them, and denounced as frivolous the complaint of one Lanan that the site selected was a "drowned bog without water." By October 8 the Seignior had a dozen houses under way, each eighteen by forty feet in dimensions. He estimated that they would accommodate three hundred troopers, but not so many members of the Loyalist families. By making use of corvees drawn from five parishes he was able to complete the structures in a month's time, when they were inspected by Captain William Twiss of the Engineers, who reported that they would commodiously house two hundred and forty women and children for whom bedding should be supplied. Twiss also suggested that if additional buildings were desired, the timber for them could be got out during the winter. Haldimand replied to these recommendations that he was ordering two hundred beds sent to Three Rivers, thence to be transported to Machiche, together with a supply of household utensils, that refugees were coming in daily of whom, he was apprised, one hundred and eleven women and children were expected from Niagara, and that he was looking for others by way of Lake Champlain. He was obliged, therefore, he wrote, to ask Gugy to build more houses as soon as the season would permit. Accordingly, the Seignior decided to erect six additional houses, besides a small structure for a school, since a Mr. (Josiah) Cass had just been elected schoolmaster. By this time some of the families were moving into their houses; but many others were forced to remain with the "habitants" until their bedding should arrive.[2]

To prevent the Loyalists from coming faster than Mr. Gugy could provide for them Haldimand wrote, November 30, to Lieutenant Colonel Carleton at Montreal to find places in that vicinity for a party whose arrival the latter was looking for, and directed that its members be supplied with such articles as they might require, including allowances of wood. However, we know that the first complement of houses at Machiche had not been filled to their capacity at this time; for a census of December 2, showing the number of refugees lodged there, gives the total as one hundred and fifty-nine, of whom thirty-

[1] Haldimand Papers, B. 164, pp. 3-5; B. 54, p. 39; B. 62, pp. 237, 238.

[2] Ibid., B. 164, pp. 3, 6, 7, 8-10, 14; B. 154, p. 106; B. 62, p. 300; B. 164, pp. 16-19; B. 62, p. 301.

two were men, ten, women, and one hundred and seventeen, children.[1] Three weeks later there was still room for forty persons in the little settlement; and Haldimand directed Carleton to send down from Montreal this number chosen out of the Niagara party. For some reason, however, these persons were not sent, but were allowed to remain under Carleton's supervision. That apartments at Machiche continued unoccupied for even a longer period appears from the Governor General's orders of February 8, 1779, to Brigadier General Powell at St. Johns (Quebec) to forward some distressed Loyalists who had arrived at that post to Machiche and to Sorel.[2]

Meanwhile, Captain Twiss was instructed to return to Machiche to assist Gugy in choosing a site for a saw mill; and the Seignior wrote to Haldimand of the growing need of a school house and an assistant to the schoolmaster, in view of the fact that there were already eighty pupils, and that certain gentlemen, including Captain Munro of Sir John Johnson's corps, were on the point of sending their boys to Machiche to receive instruction. A month later, that is, early in April, 1779, Gugy was already well along with the building of nine new houses, instead of the six previously contemplated, and towards the middle of August he wrote that the number of Loyalists had been much augmented by the different parties sent in from time to time, and that the additional houses would soon be ready for the accommodation of others. That he was not beforehand in thus increasing the accommodations for refugees is proved by the figures showing the number to whom he issued free provisions during the summer and fall of this year: at the end of June the number was one hundred and ninety-six, but by October 20 it had mounted to four hundred and forty-two. On December 3, Captain Daniel McAlpin was reported as having departed from Machiche with "other volunteers," his place being taken by Captain (Gersohm) French; but a party of Butler's Rangers had come in, whose families were said to be in dire need of clothing. Among these people from Niagara Gugy found some disreputable characters given to what he called "brigandage," which naturally caused complaints on the part of the "habitants."[3] Ten months later the Seignior received an application on behalf of several families belonging to a party conducted by Captain Bird from Detroit to Montreal. At the latter place Bird's party had to be encamped on St. Helen Island, while a message was sent to Machiche asking accommodations for thirty persons, constituting six families. As winter was approaching a supply of clothing was for-

[1] Haldimand Papers, B. 62, pp. 308, 309; B. 166, p. 2.

[2] Ibid., B. 62, pp. 344, 367; B. 164, p. 26; B. 135, pp. 22, 23.

[3] Ibid., B. 164, pp. 26, 133, 134, 58, 88, 75; B. 166, pp. 9-15, 31; B. 81, pp. 82, 83.

warded from the government stores at Sorel for Gugy's colony, as had been done in the previous fall.[1] Late in December one of the schoolmasters at Machiche, Benjamin Hobson, was assaulted by John Howard, a lieutenant in Sir John Johnson's corps. This affair afforded an opportunity to give a needed lesson to the military and at the same time render the other Loyalists more tractable, as Haldimand expressed it. The assailant was sent to Montreal and placed under bond in the sum of £50 to appear before the quarter sessions and keep the peace. A further lesson to the military came in the form of an order of January 22, 1781, requiring the enlisted Loyalists resorting to Machiche to return to their several corps. However, Sergeants William England and Henry Close were allowed to remain on the score that they were "careful in managing the disorderly set." The order explained that Gugy's settlement was intended only for women and children. It is probably indicative of the discontent of many in the colony that at the end of January fifty-four refugees applied to Haldimand for grants of land at Niagara.[2]

What action, if any, was taken in regard to this petition is not known. Indeed, for two years and two months following we have little information concerning the Loyalist colony at Machiche, on account of a gap in the official correspondence of the period. All that has come down to us relating to this interval is some figures showing the fluctuations in numbers from September 24, 1781, to July 24, 1783. At the first named date three hundred and twenty-seven refugees were receiving provisions at Machiche, four months later this number had risen somewhat (that is, to 355), while six months later still it had dropped to two hundred and sixty-five, of whom thirteen were men, sixty-eight, women, and one hundred and eighty-four, children.[3] Towards the end of March, 1783, Captain Jeptha Hawley was appointed to look after Gugy's colony of Loyalists. Hawley was a native of Connecticut who had joined Burgoyne at Crown Point, and had commanded a company of fifty men in the expedition up the Hudson. Subsequently, he had spent several years at Machiche, and was now being entrusted by Abraham Cuyler, inspector of Loyalists in the Province of Quebec, with the disagreeable task of reducing the provisions of the refugees, as a means of encouraging not a few to renew the occupations of peace, now at hand, and thereby earn a living for themselves. Some of the colonists memorialized Haldimand against the reduction, going so far as to affirm in their communication that they preferred "the last indigence to the idea of going to service

[1] Haldimand Papers, B. 164, pp. 86, 87, 89, 90; B. 163, p. 79; B. 166, p. 173.

[2] Ibid., B. 164, pp. 86, 87, 89, 90; B. 163, p. 79; B. 166, p. 173.

[3] Ibid., B. 166, pp. 83-95, 96, 111-127, 129-143.

or working for a livelihood."[1] The wail of distress on the part of many families who had once known better circumstances was still heard from Machiche in the fall of 1783, when it was voiced by Samuel Adams, who wrote (October 4) to Quebec to say that he and some of his fellow-Loyalists were thinking of settling in Nova Scotia, where they would be able to relieve their necessities by the abundance of fish and game to be found there. Later, Adams and his friends represented that they had been stricken from the provision list by Cuyler. The complaint was promptly investigated by Captain Gershom French, who reported that most of the distress of the people arose from their keeping their older children "out of service."[2]

For several months past Governor Haldimand had given considerable attentiôn to plans for forming permanent settlements of the Loyalists who had come under his jurisdiction. In November, 1783, the people at Machiche were officially invited to participate in the colonization of Townships Two and Three at Cataraqui, at the head of the St. Lawrence River. However, only twelve or fifteen families showed any inclination to join in this enterprise, and even these families raised objections on the score of the distance of the place, the difficulty of transporting provisions, the unseasonableness of the time, and their lack of cattle and farming implements which the government said nothing about providing. The schoolmaster, Josiah Cass, wrote that these considerations were causing his fellow-townsmen to take lands on seigniories and farms on shares, or try the more disagreeable method of returning to the States for the purpose of gathering "some Fragments of their former Estates." Nevertheless, Cass thought that a considerable number would agree to go to Cataraqui, if they were given encouragement equal to the undertaking. Another objection to the proposed allotment of lands was stated by Jeptha Hawley, namely, that these allotments, according to report, were not to be "free donations," but, on the contrary, were to be by leases on seigniories, with the usual reserves, acknowledgments, and services to seigniors. Hawley made it plain that the people at Machiche wanted free lands to replace the property they had lost, and had not expected that "Loyalty would deprive them of Freedom." Haldimand's secretary, Lieutenant Mathews, hastened to assure Mr. Hawley that his apprehensions were entirely unfounded, and that, although the lands were to be distributed in seigniories in conformity with the laws and customs of the country, the Crown had reserved

[1] Haldimand Papers, B. 165, p. 54; Second Report, Bureau of Archives, Ont., Pt. I, 434; Haldimand Papers, B. 164, p. 125.

[2] Ibid., B. 162, pp. 112, 113; B. 166, pp. 159, 160; B. 165, pp. 183, 205.

to itself all seigniorial rights. That this reply did not quiet the fears of the colony was demonstrated three weeks later by a communication from Captain Azariah Pritchard, who had recently visited Machiche in the interest of a permanent settlement at Chaleurs Bay, which he was promoting. While in Machiche Pritchard had noted an advertisement posted for signers to settle at the Bay of Chaleurs and at Cataraqui, and another, which Haldimand disapproved of, for signers desiring to go to Missisquoi Bay, at the northern end of Lake Champlain. He also saw a petition addressed to the Governor General, which set forth the alleged unreasonableness of the terms under which the government lands were being offered to Loyalists, and which stated that there were gentlemen in the Province of Quebec who would support such persons as would settle on their estates until these settlers could support themselves. Evidently these were seigniors in search of tenants.[1] Another evidence of the discontent prevailing among the refugees at Machiche is found in the application (December 11) of Stephen Tuttle, formerly justice of the peace of Albany County, New York, and deputy surveyor general of the province, on behalf of himself and a number of families for permission to settle on the Miramichi River in what is now northern New Brunswick. Although Haldimand made no objection to this plan, Tuttle and his party were still in the colony at the end of April, 1784.[2]

Early in the following May Seignior Gugy was able to send to Quebec lists of those who were ready to locate at Cataraqui and at the Bay of Chaleurs and one of such as were disinclined to go to either locality. As these lists are no longer extant we do not know how many names they contained; but from the testimony given before the commissioners of loyalist claims in Canada several years later we learn that a few members of various corps who had found their way to Machiche by 1783 went soon after to Chaleurs Bay, settling chiefly at New Carlisle. Among these were the schoolmaster Josiah Cass, Lawrence McKenzie, John Lane, Christopher Pearson, Thomas Shearer, Benjamin Betts, and Donald Munro. All of these men had been residents of the Province of New York, although Cass was a native of Connecticut, and Pearson had lived in Philadelphia before removing to Tryon County, New York. Most of them had joined Burgoyne's expedition, and had served afterwards to the end of the war.[3]

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[1] Haldimand Papers, B. 162, pp. 180, 227; B. 63, pp. 192, 193; B. 162, pp. 270, 271.

[2] Ibid., B. 162, p. 127; Second Report, Bureau of Archives, Ont., Pt. I, 29; Haldimand Papers, B. 63, p. 250.

[3] Ibid., B. 63, p. 267; Second Report, Bureau of Archives, Ont., Pt. I, 328, 330, 337, 338, 344.

It seems certain, however, that the greater number of the colony chose Cataraqui as their place of permanent settlement. This we gather from the correspondence between the Baron de Reitzenstein and Governor Haldimand. In his capacity as guide to those who were going up the St. Lawrence the Baron gathered together a party of two hundred and eighteen, of whom forty-five were men, thirty-five, women, sixty-eight, boys, and seventy, girls. This was a larger number than had been expected, and a few days' delay was necessary in order to obtain the supply of batteaux, or large flat-bottomed boats, for transportation purposes. But, even so, the start was made on Monday morning, May 31, with sixteen boats, and June 2 found the party at Montreal. As lodgings and provisions were not available here, the convoy was obliged to go back to Long Point and await there the arrival of tents and supplies from Sorel. On the 15th the journey was renewed, and after stops at various places the party landed at Cataraqui on the 26th. Among the number were Captain Jeptha Hawley, Isaac Briscoe, Pr. Gilchrist, Everhart Wegar, and Conrad Sills. The first two were from Arlington, Vermont, and located at Ernesttown, where Gilchrist, who was from Charlotte County, New York, also located. Wegar, formerly of Albany County, New York, took up his residence at Fredericksburg, while no definite location is given for Sills, who was a Pennsylvanian.[1] Others of the Machiche colony did not go so far as the waters of Lake Ontario to settle, preferring New Johnstown (Township No. 2, or Cornwall) a short distance above Lake St. Francis. This was the place chosen by Alexander McDonell and his two sons, John and Alexander, Jr., who had been tenants of Sir John Johnson in Tyron County, New York, before the latter's flight to Canada. John Dixson, Carton DeWitt, and John Snyder, all from the Province of New York and members of Loyalist corps, likewise settled at New Johnstown.[2] The location of a number of other men who were at Machiche in 1783, and had served in various corps, is not preserved in the records of the commissioners of Loyalist claims.[3]

While, doubtless, most of the refugee settlers at Machiche had departed before the fall of 1784, a few still remained after that time. Lieutenant William England and Abraham Crawson, the former from Kingsbury, New York, and the latter from Saratoga in the same

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[1] Haldimand Papers, B. 152, pp. 150-153, 157; B. 138, pp. 365, 366; B. 63, pp. 376, 388; Second Report, Bureau of Archives, Ont., Pt. I, 434, 437, 466, 443; Pt. II, 1262.

[2] Second Report, Bureau of Archives, Ont., Pt. I, 393-394, 455, 458; Pt. II, 1059.

[3] Ibid., 1014, 1017, 1027, 1031, 1034, 1036, 1040, 1041, 1042, 1059.

State, gave Machiche as their place of residence in March, 1788, and so also did James Glasford, of Tryon County, New York.[1] However, Gugy's seigniory on Lake St. Peter may properly be accounted as having served as a refuge for Loyalists during a period of six years, that is, from September, 1778, to September, 1784. The erection of the settlement there had cost the government £1,350, including the services of the Seignior as superintendent. During the interval of its existence it had furnished oversight, lodgings, food, and clothing to hundreds of exiles from the States, most of these being helpless women and children; and it had provided instruction for the young. If many of those who received these benefits were dissatisfied and restless, this must be attributed to their unfortunate condition, rather than to any lack of attention on the part of Governor Haldimand and Seignior Gugy. It may be added that the Seignior died, April 10, 1786. His remains were interred in the burying ground, now transformed into a park, at the corner of Dorchester and St. Urbain Streets, Montreal.[2]

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[1] Second Report, Bureau cf Archives, Ont., Pt. I, 487; Pt. II, 1079.

[2] McIlwraith, Sir Frederick Haldimand, 345.

The First Governor of New Brunswick and the Acadians of the River Saint John.

By VEN. ARCHDEACON RAYMOND, LL.D.

(Read May 27, 1914).

A recent American writer has said: "If we are to have history, let's have history. If men would occupy place and power, let it be known that the wrong, if wrong they do, will be found out, and the knowledge thereof will be perpetuated to posterity for all time. In American history we want the truth, not shadows, nor myths, nor demigods, but real men, just as they were and not as fancy, or pride, or even patriotism would have them."

This observation will apply with equal force to Canadian history, and it is in this spirit that we are now to consider the attitude of Governor Carleton and his advisers in their dealings with the Acadians who were domiciled on the banks of the River Saint John when the U. E. Loyalists came to the country in 1783. It will be found that the chief actors in this chapter of early provincial history emerge from the scrutiny with little if any injury to their reputation.

Lord Bacon has said "History maketh men wise." But it does not follow that every student of history adds to the world's knowledge, for unfortunately we must add to the Baconian aphorism another equally true, though not ascribed to Bacon Verulam—"We generally find what we are looking for."

Among the questions bound up with the history of the Atlantic provinces none has given rise to greater controversy or to conclusions more hopelessly divergent than that of the Acadian Expulsion.

In a paper read before the Society a few years ago I ventured to express the opinion that the conduct of all who were concerned in this unfortunate and sad event, victims as well as those responsible for the Expulsion, was quite natural under the existing circumstances.[1] The policy of the Marquis de la Galissonnière and of his successor de la Jonquière was not in accord with the highest standard of ethics, yet it was not an unnatural policy in those who were endeavoring, under trying and perplexing conditions, to hold Acadia for the King of France. The attitude of the French missionaries too was very natural under the conditions which prevailed.

[1] Transactions of the Royal Society, 1910, Section ii, pp. 76, 77.

And, in spite of all the hard things that have been said of Governor Lawrence and his advisers, there is no good reason to doubt that they honestly believed that the policy which they adopted was the only one that would ensure British supremacy in Acadia.

As for the poor Acadians, what people was ever placed in a more difficult and unhappy position? In their simplicity they were at a loss to know what to do. They hesitated, temporized, and in trying to please two masters were involved in a common ruin. That they would have been wiser in their own interests to have assumed a different attitude is easily said, but in view of what they were and the situation in which they found themselves, the line of conduct that they followed was a very natural one.

The controversy concerning the Acadian Expulsion is, even now, so largely influenced by racial and religious instincts that opinions the most divergent continue to be held. Everything depends upon the view-point. A mass of documentary evidence is available, much of it will be found in the Dominion Archives at Ottawa, but unfortunately the records are somewhat diverse and even contradictory. As a consequence any student, who enters upon his investigations with the design of bolstering up an opinion already formed, will have no great difficulty in finding what he is looking for, but surely this is not the way to study history.

These observations have been called forth by a recent examination of the statements made concerning the Acadians, who lived on the River Saint John in 1783, by the Abbé Casgrain, a former president of this Society. This gifted writer in his well-known book, "Un Pèlerinage au pays d'Evangéline," has made certain charges against the Loyalists and the provincial authorities which it will be the purpose of this paper to discuss. The Abbé doubtless believed them to be true; but it will be shown that, in several instances, he was badly informed. As a consequence the incidents narrated are distorted, or greatly exaggerated, and calculated to excite prejudice where none should exist. The passages that will shortly be quoted from his book are unfair to the Loyalists as a body, and unjust to Carleton and his Council, whose solicitude for the welfare of the Acadians will abundantly appear.

A short account of the first governor of New Brunswick will be in order before we proceed further.

Thomas Carleton was born in Ireland in 1735, the youngest son of Christopher Carleton of Newry, County Down. He joined the 20th regiment of foot as a volunteer in 1753, was commissioned ensign in 1755 and promoted lieutenant and adjutant the same year. Al-

though less distinguished than his illustrious brother, Sir Guy Carleton, his career as a soldier was highly creditable. He served in the expedition against Rochfort, under Sir John Mordaunt in 1757. The next year he was with the Duke of Marlborough at St. Maloes, from whence he embarked with his regiment for Minden where they joined the allied army under Prince Ferdinand of Brunswick. He was present at the battle of Minden on August 1, 1759, and the sword which he carried on that occasion, with his name engraven on the blade, is still in possession of the Carleton family. He was now promoted to the command of a company in the 20th regiment. He took part in the night attack on Hirchburg and was present at the siege of Wesel and the battle of Campen, under the hereditary prince of Brunswick, in 1760. The next year he was appointed aide-de-camp to Lord Frederick Cavendish, with whom he returned to England at the close of the war.

Carleton rejoined his regiment at Gibraltar in 1765 and did garrison duty for the next four years during which period he was absent ten months, on leave, travelling in Minorca, Algiers, France and Italy. He was quite a linguist, being acquainted with the French, German, Italian and Spanish languages.

Carleton came of a fighting stock and the military instinct led him in 1774 to obtain leave of absence to serve in a campaign with the Russian army, then engaged with the Turks on the lower Danube. He was present at an attack made by the Turks on a large corps of Russians posted on an island in the Danube opposite Silistra. The Turks were repulsed with loss, and a negotiation ensued which led to the peace of Carnaji. Carleton visited Constantinople, returned to the Russian army in Wallachia and then visited St. Petersburg, where he spent the winter, returning to England in 1775.

The outbreak of the American Revolution now turned his face in a new direction and led to his spending nearly thirty of the best years of his life in America. He came to Canada in 1776, and was appointed to the responsible position of Quarter Master General of the Northern Army, commanded by his brother Sir Guy Carleton. He was present at the naval action on Lake Champlain in which the ships of Benedict Arnold's fleet were taken or burnt. At the conclusion of hostilities in 1782 he went to England where he married the widow of Captain Edward Foy,[1] late of the Royal Artillery. She was a native of New Jersey and her maiden name Hannah Van Horne.

[1] Captain Foy had served under Sir Guy Carleton as Deputy Adjutant General. By this marriage Governor Carleton had two daughters, Emma and Anne Frances, and one son William. All were born in New Brunswick. William Carleton fought under Nelson at Trafalgar.

In July, 1784, Colonel Carleton was selected as first Governor of New Brunswick. His commission is dated the 16th of August, 1784. He was not apparently very anxious to undertake the duties of governor of the new province and at first declined the office. Afterwards he accepted it on the understanding that he was to be transferred to Quebec the next year.[1]

On his arrival at Saint John (then called Parr Town) on November 21, 1784, he was very enthusiastically welcomed by the inhabitants. They presented him with an address in which he is referred to as the brother of their illustrious friend and patron Sir Guy Carleton; they also mention his services as colonel of the 29th regiment during the late rebellion. The governor replied in modest terms.

Carleton at once set to work to organize the province. He was fortunate in having the help of a very able Council, which included such men as George Duncan Ludlow, James Putnam, Gabriel Ludlow, Isaac Allen, Joshua Upham, Edward Winslow, Daniel Bliss, William Hazen, Jonathan Odell and Gilfred Studholme. Equally important were the services of Ward Chipman the Solicitor-general and of George Sproul the Surveyor-general. Sainte Anne's Point was selected as the site of the seat of government and called Fredericton. The province was divided into counties and parishes. Magistrates, sheriffs and other officers were appointed and on May 18, 1785, Saint John was incorporated, with all the civic machinery requisite for the administration of its affairs. It is in consequence, by a good many years, the oldest incorporated city in Canada.

One of the first things to claim the serious attention of Carleton and his Council was the necessity of getting the Loyalists settled upon their lands. Lands had been, in a general way, allotted them by the Government of Nova Scotia, but in most cases the tracts remained unsurveyed and the grants had not been issued. The matter was now taken in hand with energy and the minutes of the proceedings of the governor in council show that careful consideration was given the various memorials submitted by those who desired lands. Grants were issued not only to loyalists but to "old inhabitants" and their sons

[1] See Winslow Papers, pp. 214, 221. Lord Sidney on April 19, 1786, announced the appointment of Sir Guy Carleton as Governor-General, with head-quarters at Quebec, and the position of Lieutenant-Governor of Quebec was offered to Thomas Carleton. But Lord Sidney added in his letter that the King believed that he would be of essential service if he were content to remain in New Brunswick, and Carleton at once consented to do so. Three years later there was again a vacancy in the Lieutenant-Governorship at Quebec, which the Secretary of State, Lord Grenville, stated the King had postponed filling until Carleton's wishes should be ascertained. Grenville said that the reasons for his remaining in New Brunswick still existed, and Carleton did not hesitate again to express acquiescence in his Majesty's desire.

and to the Acadians. In the eyes of the law the latter were in nearly all cases "squatters" having no title to the lands on which they lived save that of possession.

Carleton was at this time active and energetic in mind and body. During his first winter in the country he visited the principal settlements on the Saint John and fixed upon Saint Anne's Point as the most eligible situation for the seat of government. That he was a man of good physique is proved by the fact that in March, 1788, he walked on snowshoes to Quebec to see his brother, Lord Dorchester, who was reported to be alarmingly ill. This was an arduous march for a man in his fifty-third year, but the governor says that the excursion was pleasant, although his party was forced to spend eight nights in the woods.

The first impressions of all classes with regard to the governor were distinctly favourable. The publications of the day were very pronounced in his praise. A writer in the Royal Gazette, for example, observed that the governor's unexampled zeal for the welfare of the province entitled him to the love and affection of every inhabitant. Another writer described him as a man who had shown a generous contempt of his own private wealth and an exact frugality in the management of that which belonged to the public. He was admired for his integrity, firmness and benevolence. Edward Winslow affirmed that he was "a man whose dignified and correct conduct discountenanced vice and rendered morality fashionable,"

Such was the general verdict regarding Carleton at the time when he was called upon to deal with the situation of the Acadians of the River Saint John. His administration in after years it is not the purpose of this paper to discuss.

The situation of the Acadians was brought to Carleton's notice almost immediately upon his arrival. This is shown by the memorial which follows:—

"To his Excellency Thomas Carleton, Esquire, Captain General and Governor in Chief in and over His Majesty's Province of New Brunswick and its dependencies, &c., &c., &c.

The Memorial of the French Inhabitants, subjects of His Majesty King George the third, settlers on the north side of the River St. Johns,

Most humbly sheweth:—

That your Memorialists settled on the River St. Johns above St. Ann's point after the conclusion of the war in the year 1762.

That they have remained peaceably on their Farms ever since and notwithstanding both rewards were offered and afterwards threats made use of by the Americans to prevail on them to join in the late Rebellion, they remained with unshaken Loyalty and rendered every assistance in their power towards the support of his Majesty's Government and Laws.

Your memorialists therefore humbly pray your Excellency will be pleased to consider their situation, extend your benevolence to them and order them a grant of their old settlements, and by sô doing your Excellency will place them in such a situation and restore them to that peace of mind which will ever endear you to their memory. And your memorialists will, as in duty bound, for ever pray, &c.

Signed for & in behalf of yr. memorialists,

AUGUSTIN LEBLANC.

Parr 24th Nov'r, 1784."

This memorial is dated three days after the governor landed in Parr-town. It was soon after considered in Council and it was agreed that the memorial be referred to his Excellency's personal consideration after his return from St. Anne's. In due time the petitioners received a grant of 2,665 acres on the north side of the Saint John below the Keswick stream, a few miles above St. Anne.

Before we proceed further in our consideration of the measures adopted by Carleton and his advisers with regard to the Acadians, a short account of the origin of their settlements on the Saint John will be of interest.

The very beautiful part of the river just below the entrance of the Keswick stream attracted the attention of travellers in early times. René d'Amours, sieur de Clignancourt, lived there as early as 1686, with his wife and four children, and traded extensively with the Indians. He established himself at an island, now called Eccles Island, formerly called Cleoncore, a corruption doubtless of Clignancourt. Speaking of this locality in 1686, Bishop St. Vallier observes:—

"It seemed to us that some fine settlements might be made between Medoctec and Jemseg, especially at a certain place that we have named *Sainte Marie*, where the river widens and is interspersed with a large number of islands which apparently would prove very fertile if they were cultivated. A mission for the Indians might well be established there; the land has not yet any owner in particular, neither the King nor the Government having made, up to the present, a grant to any one.[1]"

This place was afterwards known as Aukpaque, or Ekouipahag, from the Indian *Ek-pa-hawk*, signifying "head of the tide" or "beginning of the swift water."[2] There was a large Indian village here and some Acadians lived in the vicinity. A more extensive Acadian

[1] *Estat présent de l'Eglise et de la Colonie Française dans la Nouvelle France*, par M. l'Evéque de Québec, Paris, 1688, pp. 80, 81. Medoctec, mentioned above, was a well-known Indian village, situate a little below Woodstock, about 138 miles from the mouth of the St. John river. At Jemseg, about 50 miles from the mouth of the St. John, there was a fort which was at one time the headquarters of French authority in Acadia.

[2] The tide of the Bay of Fundy is manifest as far up the river as Aukpaque which is ninety miles from the mouth of the River.

settlement sprang into existence a few miles below at Saint Anne's Point. This village was pillaged and burned in the month of February, 1759.

According to the statement of a British officer, Captain John Knox, who was at the time in the garrison of Annapolis Royal, a party of New England Rangers marched from Fort Frederick eighty miles up the river on snow shoes and burned one hundred and forty-seven dwellings houses, two mass houses, and all the barns, stables and granaries. Cattle, horses and hogs were destroyed, six Acadians were killed and *scalped* and others taken prisoners. The remnant fled to the woods, where they maintained a precarious existence after the Indian fashion. Some of them went to Quebec but others clung to the locality. The barbarity attending this mid-winter foray was strongly condemned by Lord Amherst, the commander of the forces in America. Those who participated in it were not British regulars but the provincial troops of Massachusetts.

In the summer of 1763 Studholme, the commanding officer at Fort Frederick, was instructed to order the Acadians lingering about Saint Anne to remove. They appealed to the Governor of Nova Scotia, expressing a hope that in pity for their past miseries they might be spared further suffering. They stated that they were just beginning to emerge from the condition of wretchedness to which they had been reduced by the late war. The prospect of an abundant harvest promised to provide for their wants during the coming year. "If you insist upon our removal before the harvest," they say, "most of us, being without money or supplies or any means of conveyance, will be driven to live like the savages, wandering from place to place. But if you allow us to stay the winter, in order to secure our crops, we shall then be able to cultivate the lands wherever you may bid us go. We need not tell you that a farmer who takes up new land without having supplies for a year must inevitably be ruined, and of no use to the government he belongs to. We hope, sir, that you will be good enough to grant us a priest of our faith. Such a concession would enable us to bear with fortitude the troubles inseparable from such a migration."

Studholme seems not to have taken any active measures to dispossess them, and during the next twenty years their numbers gradually increased.

About the same period another Acadian settlement was established near the Kennebecasis at the place still called the French Village. Some of these people were employed in the construction of a dyke and aboideau by Hazen, Simonds and White, who were the proprietors of the great marsh east of the city of St. John. When the work was

completed it had the effect of shutting out the tide from six hundred acres of valuable marsh land. The fact that these people were experienced in dyking shows that they were refugees of the Expulsion.

The request for a resident priest was complied with in 1767, when Father Charles François Bailly came to Aukpaque—or, as he terms it, "*la mission d'Ekouipahag en la rivière St. Jean.*" The register of baptisms, marriages and burials during his term of residence is still to be seen at French Village in the parish of Kingsclear, York County. His flock included Acadians and Indians.

For some reason the presence of the Acadians on the St. John was not approved by the government of Nova Scotia and provincial Secretary Bulkeley wrote in 1768 to John Anderson and Francis Peabody, who were justices of the peace:

> "The Lieut. Governor desires that you will give notice to all the Acadians, except about six families whom Mr. Bailly shall name, to remove from Saint John's River, it not being the intention of the Government that they should settle there, but to acquaint them that on their application they should have lands in other parts of the Province."

What the magistrates did or tried to do is not recorded. At any rate they did not succeed in removing the Acadians, for the little colony continued to increase. At times the inhabitants were obliged to adopt the mode of life of their Indian neighbours to save themselves from starvation, yet they clung to the place and when the Loyalists arrived in 1783 a committee of exploration, sent by Major Studholme, found an Acadian colony above Saint Anne which numbered 354 souls, viz., 61 men, 57 women and 236 children.

In their report the committee state:—

> "Above St. Anne's we formed a considerable number of French settlers, many of whom had been in possession a number of years. They in general appeared to be an inoffensive people, but few if any have a legal title to their lands and as they are in general nearly in one and the same situation, we thought it unnecessary to be very particular in our account of every individual. Those who have more than a simple possession to plead in their favour we have properly noticed."

The names of the settlers, the number in each family, the length of time settled on their locations and some other particulars are recorded in the report of the committee."[1] Those claiming longest residence were Joseph Martin, who came in 1758, and Joseph Doucet, who came in 1763. Of the sixty-one families mentioned, thirty-six came at the time the Abbé Bailly took up his residence there, or in the course of the next two or three years. There is ground for believing that some of those who settled in the vicinity of Sainte Anne had fled from Beaubassin to Canada at the time of the general deportation

[1] Collections of the New Brunswick Historical Society, Vol. I., pp. 110-113, 117

in 1755, returning to the River St. John after the peace in 1763. This was the case with members of the Cormier family, as is related by the Abbé Casgrain in the extract from his book shortly to be quoted."[1] There was a tradition to the same effect in Madawaska in early days. Edward Kavanagh, a member of the Maine State legislature who made a tour of inspection of that settlement in the summer of 1831, makes the following statement in a letter written after his return:—

> "I deem it material in treating of the history of the Acadian, or neutral French, to present in prominent relief the facts attending their several migrations. . . . . . . When their settlement was broken up in Nova Scotia, a few families escaped from the troops and settled themselves on the Kennebeckasis and others near the Baye des Chaleurs; but the young men who were not encumbered by wives and children fled to Quebec, then under French rule, there they remained until the cession of Canada to England in 1763. This event caused them to quit Canada and they removed to a place which they afterwards called St. Anne, where the town of Fredericton has been since built. It was at that time a wilderness.[2]"

Of the families whose names appear in the Abbé Bailly's register the Cormiers, Daigles, Cyrs and Héberts were from Beaubassin at the head of the Bay of Fundy, the Martins from Port Royal, the Mercures and Theriaults from Isle St. Jean (Prince Edward Island), the Violettes from Louisburg and the Mazerolles from Rivière Charlesbourg.

Father Bailly returned to Canada in 1772 and was subsequently coadjutor Bishop of Quebec.

The records of the provincial government in Fredericton enable us to fix approximately the location of the majority of the Acadians in the little colony above Sainte Anne. They were scattered along the banks of the Saint John for a distance of ten or twelve miles. A few of them lived on the islands below the mouth of the Keswick stream. The principal locations, however, were at and near the mouth of the Keswick, on the north side of the Saint John, and at the upper and lower villages on the south side of the river. A few of their descendants live at these villages at the present day. During the American Revolution most of the Acadians were loyal to the government of Nova Scotia, and some of them rendered important services as couriers and in other ways. It is worthy of note that in spite of the vicissitudes and hardships they endured there were instances of great longevity among them. Michel Vienneau, who lived at Maugerville (below Sainte Anne) in 1770, died at Memramcook in 1802 at the age of 100 years and 3 months. Thérèse Baude, his widow, died in 1804 at the age of 96 years. Their son Jean died at Pokemouche in 1852 at the extraordinary age of 112 years, leaving a son

[1] Un Pèlerinage au Pays D'Evangéline, Duxième Edition, 1888, p. 494.

[2] Collections New Brunswick Historical Society, No. 9, 1914, pp. 483, 484.

Moïse who died in Rogersville in 1893, aged 96 years. The united ages of these four people, father, mother, son and grandson, reach the extraordinary sum total of 404 years.[1]

At the time of the Revolutionary War the Acadians of the Saint John and those on the River Kennebecasis were ministered to by the Abbé Joseph Mathurin Bourg, the first native born priest in Acadia. The loyalty of the Acadians to England and the peaceful attitude of the Indians was due in no small measure to his efforts.

After the cessation of hostilities the implacable animosity of the Americans to those of their countrymen who had served on the side of the king caused the commanding officers of fourteen Loyalist regiments to unite in requesting that grants of lands be made to them in some of his Majesty's remaining provinces, and that they should be assisted in making settlements in order that they and their children might continue to live under British Institutions. The regiments were sent by Sir Guy Carleton, late in 1783, to be disbanded on the River Saint John and Governor Parr was instructed to provide for their settlement.

The circumstances attending their arrival are detailed in the following letter of Major Prevost, the deputy Inspector of Provincial Forces, who was sent to superintend the disbandment.[2]

St. Johns River 29th Sep'r 1783.

My dear Sir,—We arrived here the 26th the transports *Martha* and *Esther* excepted. Gen'l Fox and Col. Winslow were just set out for their expedition up the River. They are expected back in a few days. I need not tell you how much I wish to see the latter.

It is impossible to describe to you the confusion we are in at this place for want of crafts sufficient to transport the troops to their destination. I hope Gen'l Fox will exert his authority to relieve them from the distress they labour under otherwise it is impossible to say what will become of one half of them when once they are disbanded.

I am preparing to set out in a small craft, which I have hired at my risks, with 120 B'ls. of Provisions for the place where the grand Depot is to be made, and where I dare say the whole will winter, called St. Ann in Sunbury Parrish [3] 90 miles distant; but this I will not do before the General's arrival and that my exertions are no longer wanted at this place—and by the 20th of next month hope to return so as to take my passage on board of the same transport that brought me here. . . . . . .

[1] I am indebted to Placide P. Gaudet Ottawa for this interesting bit of information.—W. O. R.

[2] This letter has never before been printed.

[3] Should be Sunbury township: there were no "parishes" until after the organization of the Province of New Brunswick.

I can say little of the Country as yet but on my return I think I shall be a tolerable judge when I will give you every information I can collect—till then believe me to be with affectionate and sincere regard and esteem.

Your obliged and most H'ble Serv't

AUG. PREVOST.

Ward Chipman Esq'r.

By direction of Governor Parr the Surveyor-general of Nova Scotia laid out (on paper) a succession of blocks of land, on both sides of the River Saint John, beginning at Saint Anne and extending upward. Each block had a frontage of about twelve miles on the river. They were numbered in order and were drawn by lot. The draft resulted in placing the regiments in the following order ascending the river.

West Side of River.	*East Side of River.*
2nd New Jersey Volunteers.	Maryland Loyalists.
Kings American Dragoons.	Royal Guides and Pioneers.
Kings American Regiment.	Queens Rangers.
De Lancey's 1st battalion.	Pennsylvania Loyalists.
New York Volunteers.	De Lancey's 2d battalion.
Loyal American Legion.	Prince of Wales Amer'n. Regt.
3d. New Jersey Volunteers.	Loyal American Regiment.
1st. New Jersey Volunteers.	

Some of the officers and men spent a calamitous winter in huts or canvas tents at St. Anne. The majority, however, remained at the mouth of the river, or were sheltered in the homes of the older inhabitants at Maugerville and Sheffield. There was much delay in surveying the lands that had been assigned to the several corps, and the dissatisfaction consequent on this was one of the causes of the division of the Province of Nova Scotia.

When the disbanded troops began to take up the lands allotted them, it was found that a good many of the best locations above St. Anne were in possession of the Acadians who had, in some instances, made considerable improvements. These improvements were chiefly in the blocks granted to the 2nd New Jersey Volunteers, the Maryland Loyalists and the Royal Guides and Pioneers. The Acadians, unfortunately, were settled without any title to the lands they occupied, except that of possession, and their claim to consideration was lessened by the fact that they had been notified on more than one occasion that it was not the intention of government that they should settle

there.[1] As the lands were fertile they excited the cupidity both of the old English speaking settlers and of the newly arrived Loyalists.

In considering the trouble that speedily developed, we must bear in mind that in all countries old soldiers are not disposed to be very considerate where their personal interests are concerned, and more particularly so when they think that they are denied their rights. We must bear in mind too the vexatious delays in allocating the lands that had been promised them before they sailed from New York. The hardships of the first winter under canvas at Parr-town and Saint Anne had left its mark upon them. Winslow described their situation at the time of their arrival, in the following words in a letter to his friend Chipman:—

> "I saw all those Provincial Regiments which we have so frequently mustered landing in this inhospitable climate in the month of October without shelter and not knowing where to find a place to reside. The chagrin of the officers was not to me so truly affecting as the poignant distress of the men."

This was only the beginning of their anxiety and distress. After a wearisome delay they proceeded to their locations only to find, in some instances, that the lands promised them in the King's name were in possession of "squatters." It need not be a matter of wonder that they did not regard those in possession with favour, whether they were Acadians or old English settlers. Many of the old soldiers doubtless treated in supercilious fashion the primitive people who, out of sheer necessity, hunted, trapped and fished in true Indian fashion, and whose language they could not understand. But the disbanded troops are hardly to be regarded as fair representatives of the general body of Loyalists. Among the latter were persons of kindly heart and of the highest culture and refinement. In our investigation of the points raised by the Abbé Casgrain it is better to rely upon documentary evidence than upon tradition.

Like his illustrious brother Lord Dorchester, Governor Carleton was a man of humane and generous disposition, and in the performance of his public duties anxious to act with impartiality. From the first he was disposed to deal considerately with the Acadians. Even before his arrival some attention had been given to their condition by the authorities of Nova Scotia. Major Studholme was instructed by Governor Parr to investigate the claims of all the settlers on the Saint John to the lands in their possession. He accordingly appointed a committee of four persons to make a tour of exploration and collect the required information. Those chosen for the task were Ebenezer Foster and Fyler Dibblee, who were Loyalists, and James White and Gervas Say who were old inhabitants of the County; all were men of

[1] Raymond, History of the River Saint John, 1910, pp. 362-415.

ability and integrity. The committee was directed "to collect the best information that was possible respecting the titles, claims, character, principles and deserts of those people settled on the lands commonly known by the appellation of Amesbury Tract, the Townships of Gage, Burton, Sunbury, New-Town, Conway and the lands formerly granted to one McNutt." The committee was appointed June 15, 1783, and the report which they shortly afterwards submitted to Studholme is a very interesting document.[1]

The families mentioned in the report who lived on the river below Saint Anne were English; those settled above were Acadians. In nearly all cases the settlers had no title to their lands save that of occupation; in other words they were "squatters." When tracts of ungranted lands were set apart for the Loyalists it was found that a good many lots in the tracts were in possession of "old inhabitants" and Acadians. The Loyalists on attempting to take possession were stoutly opposed by those who lived on the lots. Parr and his Council, after due consideration agreed that the Loyalist grantees must pay the occupants for the improvements that had been made before demanding possession. This stipulation was a source of dissatisfaction to the Loyalists. It was notorious that the majority of the old New England settlers on the Saint John were disaffected to the British cause at the time of the Revolution. Some of them had even taken up arms on the side of the Americans. In the opinion of at least one vigorous old Loyalist, who came to live amongst them, "they deserved halters to a man." This observation is not likely to be endorsed by any fair-minded historian, yet great allowance must be made for the heated utterances of men who had suffered so much at the hands of their adversaries as had this self-same Loyalist. They had been persecuted and banished, their lands seized and confiscated and they were not disposed to extend much consideration to any settlers on the Saint John who had sided with the Americans. I am satisfied, after careful investigation, that the irritation displayed by the Loyalists because of the consideration shown by government to the disloyal settlers from New England, was far greater than any that was felt towards the Acadians. For more than a generation there was strife and ill will between the old New England settlers and the Loyalists in Sunbury County. The name of "Blue-nose" had its origin as a scornful epithet applied to the older inhabitants by the Loyalists. The designation is now accepted with equanimity by all classes of people in the maritime provinces, but it was not always so. For years the line of demarcation was clearly defined between

[1] The report of Studholme's Committee of exploration will be found in the Collections of the New Brunswick Historical Society Vol. I, pp. 100-118.

the Loyalists and the older inhabitants, and their mutual relations were by no means cordial in matters pertaining to social life, religion or politics.

The statements in the Abbé Casgrain's book to which exception must be taken are chiefly those which follow. They are given in translation.

Speaking of the period that followed the expulsion Casgrain observes:—

"The period of evil days, however, was not yet ended for the poor Acadians, another kind of trouble for them had begun. To open persecution there succeeded underhand persecution, prompted by the spite of subordinate officials in defiance of the express wishes of England and of the Governor. Obstacles accordingly were put in the way of the contiguous settlement of families. Care was taken, for example, that an Acadian should be placed between two protestant proprietors, and also that his land should not be situated along the coast but in the interior. Moreover the manner of conceding land merely by a title of temporary permission to possess it, adopted by Nova Scotia, was not calculated to reassure the distrustful spirit of the Acadians, who had been so frequently deceived. That there was reason to mistrust this temporary permission the subsequent course of events will sufficiently prove. I will only cite one instance.

In 1784, that is to say after the lapse of thirty years, some of the dispossessed in 1755, who had settled on the River Saint John, were again dispossessed in favour of some American loyalists and disbanded soldiers who had merely to seat themselves at their tables and eat of their bread, and become henceforth rulers and masters of the lands that had been bedewed by the sweat of an outlawed people. The unhappy Acadians, helpless against the forces arrayed against them, could do nothing but betake themselves to the woods. They ascended the River St. John thirty leagues from any habitation and axe in hand opened up the intervals of Madawaska, where they have multiplied with the marvellous fecundity for which they are noted."[1]

In the same connection we have the following passage:—

"Pierre Cormier was considered the most prosperous settler in Chignecto. Having been taken in arms at the fall of Beauséjour he was condemned to be shot, but he escaped from imprisonment through the devotion of one of his sisters who brought him the garments of a woman. In this disguise he deceived the vigilant sentinel and rejoined his family and brethren who had hid themselves in the forest, from whence they proceeded to Canada.

Upon the return of peace a number of persons, among them Pierre Cormier, joined a party of their compatriots who had decided to begin life afresh as tillers of the soil in the mission of Sainte Anne on the St. John River. In a few years their active hands had caused the wilderness to blossom; their barns were filled with sheaves and their stalls with cattle. They had begun to forget the storms through which they had passed, when fresh rumours of war fell upon their ears. This proved to be the commencement of the American Revolution." [After stating that the Acadians, following the example of their brethren in

[1] Un Pèlerinage au Pays D'Evangéline, Deuxième Edition, 1888, pp. 320-322.

Canada, refused every invitation to side with the Americans, the Abbé continues: "The good sense of the Acadians stigmatized in one word this fratricidal war of English versus English: it was called by them the *Silly War* (*la guerre folle*), and even to this day they do not designate it by any other term. How these *useful subjects*[1] were repaid for their loyalty at the close of this war is well known. The province in which they lived, since known as New Brunswick, became a place of refuge for those persons in the United States who had adhered to the British cause. It is not without interest to observe, in passing, that among the number of the fugitives was the family of Winslow, whose part at Grand Pré is well known. He experienced in his own family the punishment of banishment which he had inflicted upon the innocent Acadians."[2]

Farther on in his book the Abbé Casgrain says:—

"After the arrival of the Loyalists there came a body of troops that had received British pay and at the close of the war had been disbanded. Those of the unhappy Acadians that had not already been ousted from their lands immediately became the prey of these strangers; they burned their fences, stole their cattle; during the extreme cold of winter they broke open their cellars so that their store of potatoes might freeze. They went so far as to carry off by force the women in their houses.

One evening some Acadians who were returning from a visit at the house of a neighbour saw some Loyalists dragging along with them a young girl whom they had blind-folded. The Acadians made a rush to free her from their hands and only succeeded in so doing after they had encountered several pistol shots."[3]

Lastly we have to consider the truth of the following statement:—

"The Indians who still live at the mission of Sainte-Anne, and who have always lived in peace beside the Acadians, were not more exempt than they from these indignities, and in the end were robbed of their reserve.

One day some Loyalists, strolling along the bank of the River St. John, spied a canoe paddled by Indians coming up the river. 'I have a good mind,' said one of them, raising his musket, 'to put a ball into the head of that squaw,' and before his companions, who wished to stop him, had time to deflect his aim, the shot was fired and the Indian woman tumbled stark dead in the canoe. No sooner was the news of this crime generally known in the Indian mission than the whole tribe rose as one man; a deputation of chiefs waited upon the Loyalists and called upon them to deliver up to them the murderer. In case of refusal they threatened war to the death.

The Loyalists, being intimidated, gave him up, and he was dragged at once to their village, stripped of his garments, fastened to a post and burned alive.

The settlement on the River Saint John became a living hell (*un enfer inhabitable*) for the little band of Acadians who held to their lands. Some of them went away and rejoined their dispossessed brethren who had founded the Madawaska colony; others, among them Pierre Cormier and his family, traversed the forest wilderness that separated them from the isthmus of Nova Scotia, and sought refuge with their brethren at Memramcook."[4]

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[1] Un Pèlerinage au Pays D'Evangéline, Deuxième Edition, 1888, p. 122.

[2] Ibid. pp. 494-496.

[3] Un Pèlerinage au Pays D'Evangéline, Deuxième Edition, 1888, p. 496.

[4] Un Pèlerinage au Pays D'Evangéline, Deuxième Edition, 1888, pp. 496, 497

It is not necessary that we should deal with the foregoing extracts seriatim or at great length, nor is it the desire of the writer to appear in the role of a special pleader. It will be quite sufficient to show by documentary evidence that the traditions, on which the statements just quoted are presumably based, are exaggerated and distorted. In some cases there is just enough truth commingled with error to call to mind the words of Tennyson:

"A lie which is all a lie may be met and fought with outright,
But a lie that is part of a truth is a harder matter to fight."

Let us, for example, proceed to investigate the tragical story of the alleged murder of the Indian woman by one of the Loyalists.

That there may have been a current rumor to this effect is shown by Lord Dorchester's letter to Governor Carleton, dated at Quebec, January 3, 1787. In his letter Dorchester urges that the Indians should be treated with kindness and civility. "It has been reported," he says, "that a soldier shot one of them and wounded a woman. It is also said that the malefactor has been hanged. If so justice has been satisfied, but the Indians should be assured of the fact."

It will be noticed that the version of the tragedy in Lord Dorchester's letter differs considerably from that recorded by the Abbé Casgrain. And now for the *facts* as they are presented in the records of the Supreme Court of New Brunswick.

David Nelson and William Harbord, two disbanded soldiers, late of the Queen's Rangers, were arrested in May, 1786, for shooting an Indian named Pierre Benoit. They did not deny the shooting but sought to excuse themselves by denying any intention to kill. They were examined before Judge Allen and Edward Winslow, Esquire, on Wednesday the 24th of May, the shooting having occurred the previous Saturday. The prisoner Nelson made the following statement:

"This Examinant, David Nelson, saith,

That last Saturday, the sun about half an hour high, my comrade William Harbord and I went down to the river to try to catch some fish. After being there a little while we heard dogs by the house after our hogs. I dropped my pole and ran to the house and took my firelock and went just above the house, where I found two dogs gnawing one of my hogs, which they had killed. When the dogs saw me they ran, and I fired at them. I also spoke to Wm. Harbord and desired him to fire, which he did and killed one of the dogs

I then desired Harbord to go with me and see if the other hogs were missing, and we went in search of them but could not find any of them. I then said the hogs must be taken into a boat; whoever owns the dogs must have the hogs.

We then went to the shore and discovered some Indians in a canoe about a quarter of a mile above us. We beckoned to them to come to and called to them to stop. He answered, no, no, and said, you have killed my dog. I

repeated to him to stop, and said, You have got my hogs. He then pushed away across the river, which confirmed us in the opinion that he had got the hogs in the canoe. William Harbord then said, Let us fire over his head, may be he will hear the balls and come to, on which both William Harbord and myself fired in order to make them come to, but without any design or intention of killing or wounding the persons in the canoe. I then loaded and fired a second shot for the same purpose. We then went again in search of the hogs and found all but one, which we still supposed was in the canoe."

The statement made by Harbord was substantially the same. The unfortunate occurrence caused great excitement not only among the Indians but amongst the white settlers.

Winslow wrote to Chipman, the solicitor general:

"The Indians on the one hand are clamorous for an instant decision. The people of the country, however, cannot reconcile themselves to the idea that two men of fair character, should be sacrificed to satisfy the barbarous claim of a set of savages. They are almost persuaded to a man that the prisoners had no ill intention. In this situation you will naturally suppose that we have an arduous task to keep them quiet. We have assured both parties that the men shall be tried fairly and if guilty that they will be punished."

On the 13th of June, 1786, the court opened at Fredericton for the trial. Chief Justice Ludlow and Judge Allen being on the bench. The prisoners on being indicted for killing the Indian pleaded "not guilty." Ward Chipman conducted the prosecution. The prisoners were not defended by counsel, it not being the practice at that time to allow counsel to prisoners on trial for capital offences except to argue questions of law. No Indian was called as a witness, although the squaw of Benoit was with him in the canoe when he was shot.

The administration of justice in those days was swift. The prisoners were both found guilty of murder and sentenced to be hanged, on the 23rd of the month, just ten days after the opening of the court and only a month after the commission of the offence. Nelson was executed but Harbord was pardoned. A petition was presented in his behalf by the grand jury. It was shown at the trial, or such was the reasonable inference, that it was the second shot fired by Nelson that killed the Indian. Harbord having only fired once was innocent of the actual killing. The impression prevailed that if Nelson had not been executed the Indians would have had revenge upon the settlers; but seeing that justice was done they were satisfied, and were afterwards for the most part peaceable and well behaved.

There can be no reasonable doubt that this is the true story out of which the lurid tale in Casgrain's book has been evolved. Had it actually happened that an English settler, in retaliation for shooting a squaw, had been seized by the Indians, dragged to their village and there, stripped of his clothes and fastened to a post, had

been burned alive, there would assuredly have been some tradition concerning it among the descendants of those settlers. There is none. The writer's own ancestors lived not many miles from where the tragedy is said to have occurred and never heard of any white settler having been burned alive as they certainly would have done if such a thing had happened.

The statement that the Indians were *robbed* of their reserve may next be considered.

At the time of the shooting of the Indian Benoit, Winslow wrote to his friend Chipman that the whole corps of Indians had encamped about Colonel Allen's house, which was in the vicinity of their village, and that their rudeness had greatly distressed his family. "Allen," he adds, "has lately made a contract with them for a lot of land, and they think that they have a right to call on him whenever they please. This event has increased their familiarity."

Under the agreement with the Indians Colonel Allen rented their reservation of 500 acres for the sum of $100.00 per annum. He afterwards, in 1794, purchased of them the reserve and the island in front of it called Savage Island, for the sum of $1,650.00. The purchase was approved by the Governor in Council. The Indians are said to have squandered the money derived from the sale of their patrimony. They would undoubtedly have been wiser to have retained it, but Casgrain's statement that they were "robbed of their reserve" is not in accordance with fact. Judge Allen and his family invariably displayed much kindness to the Indians and they were never sent hungry from his door.

Next, with regard to the indignity to which the young French girl is said to have been subjected. No apology can be offered, or will for one moment be attempted, for such an outrage, further than to observe that the general body of the Loyalists should not be held responsible for the misconduct of a few of the disbanded soldiery. This class of people in all ages and in all countries has contained a rough and immoral element which has had to feel the wholesome restraint of the strong arm of the law. The laws of the province were enforced in its early days against two soldiers in Fredericton for an assault upon an English woman, and, although her reputation was not of the best, they were summarily punished.

There is not the slightest doubt, however, that the Acadians found in the disbanded soldiers uncongenial neighbours. Edward Winslow, in a letter written at Fredericton, May 21, 1786, observes:

> "While I am writing a number of Frenchmen, who have been most unjustly ousted of their land, which was reserved by the government of Nova Scotia, have made application to me and solicited proceedings against the trespassers."

Winslow, it may be observed in passing, was a nephew of General John Winslow who was actively employed under Shirley and Lawrence in the deportation of the Acadians of Grand Pré. He was in no way responsible for the part played by his relative in the expulsion. He was a man of kindly nature, friendly to the Acadians, and when he filled the office of President and Commander in Chief of the province in 1808 treated them with consideration.

Lord Dorchester, writing to his brother on January 3, 1787, sent a conciliatory message to the Acadians, having heard that they had "not only been driven off their lands, but in other ways ill treated." He recommended that, in order to prevent a misfortune of the kind in future, grants should be made out for them in the customary form. The Governor had already taken steps to this end of which we shall presently speak more particularly.

When Edward Kavanagh and John G. Deane visited the Madawaska region in 1831 they were told by the settlers of the troubles the founders of their settlement had experienced at the hands of the disbanded troops. Kavanagh endeavored to make use of the information in the interests of the United States in connection with the north-eastern boundary dispute, which had then entered upon an acute stage. He states that the Acadians who repaired to Saint Anne after the treaty of 1763 desired to remain unknown. He adds:

> "They gathered on that spot some of the remnants of their race and commenced cultivating the soil, acknowledging no allegiance to any power on earth and most certainly disinclined to court the attention of British barbarity. In 1784 they were discovered and their lands were granted to a disbanded regiment of Refugees, commanded by one Colonel Lee (of Massachusetts) it is said. The first notice which these simple people had of the fact was the appearance of British surveyors in their peaceful region. They remonstrated, and as a matter of special favor they were told that each might retain his dwellings house and 200 feet of land about it."[1]

Kavanagh's remarks are not by any means accurate. The authorities of Nova Scotia did not first learn of the existence of the Acadian settlement near St. Anne in 1783, they knew of it almost from the beginning. Letters were addressed to the commanding officer at Fort Frederick concerning the Acadians there as early as 1763. The missionary Bailly went to them in 1767 with the approval of the Nova Scotia government. The resident magistrates on the river received instructions in 1768 to limit the number of settlers to those approved by Father Bailly. During the Revolutionary war Major Studholme employed the brothers Mercure and Martin as couriers. James Simonds, James White and William Hazen, who were magistrates appointed by the government of Nova Scotia,

[1] Collections New Brunswick Historical Society No. 9, 1914, p. 484.

knew the Acadians well and had business transactions with them for more than sixteen years before the coming of the Loyalists. Studholme commends the services of five members of the Martin family (whom he mentions by name) who during the Revolutionary war had great merit in exerting themselves for the good of the King's service. The Acadians were not unknown. The only instance of "British barbarity" which they suffered was at the hands of the troops of Massachusetts in garrison at Fort Frederick in their midwinter raid in 1759.

When the 2nd New Jersey Volunteers proceeded to their location above St. Anne's Point, in the present parish of Kingsclear, they were under command of Captain Joseph Lee, a native of Trenton in New Jersey. He is the officer referred to by Mr. Kavanagh as "one Colonel Lee of Massachusetts, as it is said." Lieut. Col. Isaac Allen on his arrival, a little later, became the leading man in the community.

Complaints as to the misconduct of the disbanded soldiery came from various quarters. Robert Smyth of Ireland claimed possession of a lot of land in the lower part of the present city of Fredericton, granted under the great seal of Nova Scotia in 1765. Some improvements had been made by his tenant Philip Wade as appears from Mr. Smyth's statement in his memorial to Carleton, considered in Council July 13, 1785:—

> "In 1783 great numbers of Loyalists from New York arrived on the River St. John's, some of whom have raised buildings for temporary accommodation on your memorialist's lands, and in the same year Mr. Wade the memorialist's attorney was prevented from making further improvements by the new comers who took possession of the lands, burnt his fences, threatened his attorney's person and even went so far as to give Wade formal notice, under the pretext of the sanction of the Government, to desist from his improvements."

The minutes of the Council indicate that the lands on which the tenant resided were not sufficiently improved to save them from escheat, but Mr. Smyth was told that "as soon as the needy are provided for Mr. Smyth, on becoming an inhabitant of this Province, will be considered as entitled to a liberal grant."

It was probably on the lands claimed by Robert Smyth that the advance guard of the Loyalist troops passed their first winter in the country. Some of them were able to build rude huts, but others lived in canvas tents, only rendered habitable by the banks of snow that lay six feet deep in the open spaces of the forest.[1] Most of those who wintered at St. Anne's Point in 1783-4 were members of the 3rd New Jersey Volunteers, others were of the Kings American Regiment.

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[1] The terrible experience of these people during their first winter are narrated in Raymond's History of the St. John River, Second Edition, 1910, pp. 547-550.

The Acadians, who were interfered with by the soldiers, did not fail to represent their grievances to the government; witness the following memorial:—

To His Excellency Governor Carleton,
Captain General and Commander in Chief, &c., &c.

The memorial of the French Inhabitants, which have been deprived of their Lands by the disbanded Troops, as also of Joseph Daigle and Paul Potier now residing at Madawaska—Humbly Sheweth—

That the Memorialists are reduced to a most deplorable condition with their numerous Families for want of Provisions, some having been under the Necessity of selling the few Cattle they had to prevent them from starving.

That Mr. Biddle[1] now Possess the Proportion of Land allowed by Government to one of the Memorialists, by name Joseph Doucette, without making him the least restitution for it.

That Bona Roy,[2] another of said unfortunate Memorialists has been forcibly compelled to leave his House and received no consideration.

That Memorialists thus circumstanced was under the Necessity of having recourse to your Excellency for redress of their complicated Miseries and a supply of Provisions.

And Mem'sts will pray, &c.

Fredericktown, Feb. 22nd, 1786.

The Governor and Council held their meetings at this time in Saint John, where the Governor then resided, and it was agreed to send a copy of the memorial to Colonel Allen for investigation. The Colonel, being on the ground, it was doubtless felt would be able to do justice to all parties and the Council had every confidence in his fairness and integrity. Of the Acadians mentioned in the memorial Joseph Doucet had been on the river since 1763, Paul Portier since 1767 and Joseph Daigle since 1769. Daigle had carried express messages for Major Studholme and was deemed a leading man in the Madawaska settlement in its early days.[3]

[1] John Biddle was a surveyor, at this time engaged in laying out lands for settlement. He died in 1801 and his widow Sophia Biddle advertised for sale by public auction his estate of 500 acres "situate in what is called The Lower French Village, nine miles above Fredericton, forty acres of which is cleared Intervale of the first quality, and fourteen acres of Upland cleared and under cultivation; a comfortable house and good barn thereon."

[2] Benoit Roy was reported by Studholme's Exploration Committee in 1783 as having been on his location two years, having a wife and 5 children and 4 acres cleared.

[3] See the following letter to Joseph Daigle, a copy of which is to be found in the records of the provincial government:

Fredericton, 17 Septr., 1796.

Sir,—I am directed to inform you, and to request you will notify the Inhabitants in your District thereof, that His Excellency the Lieut. Gov'r. has been pleased to dismiss Mr. Thomas Costin from the office of a Justice of the Peace, and he is no longer qualified to act in any case whatever as a magistrate in this Province.

I am Sir, Your most Obedient &c

(Signed) JON. ODELL.

The instances quoted suffice to show that there was not a little disputation over the question of possession of lands, not only between the Loyalists and Acadians but also between the Loyalists and the older English settlers. The situation was complicated by the fact that the lands in dispute were in some instances included in the grant of the township of Sunbury made in 1765 to Thomas Falconer and his associates. These lands, not having been declared forfeit by the court of escheats, the provincial authorities were not in a position to give a title to any applicant. As an example of this—on July 1, 1788, Jean Martin, Simon Martin and Joseph Martin, Acadians of the Lower French Village, submitted a memorial to the Governor in Council asking to be confirmed in possession of the lands they occupied and specifying their disputes with John Easty and Peter Parlee as to their boundaries. The answer they received was, "The land is not escheated."

While the documentary evidence extant shows that there was a good deal of bickering over the question of the rightful ownership of the lands, there is nothing to warrant the statement of the Abbé Casgrain that the settlement above Saint Anne became *un enfer inhabitable* to the little colony of Acadians who had settled there. That the place was not "uninhabitable" is indicated by the fact that, in spite of the inducements held out to them to remove, members of the Acadian families Gaudin, Mazerolle, Roy, Bourgoin, Martin and Cyr remained on their old locations, where there are living to day more than four hundred of their descendants.

However the majority of the Acadians did not like their neighbours and of their own initiative set on foot a movement to establish themselves elsewhere. To say that they *fled* to Madawaska or to the eastern parts of the province is untrue. Louis and Michel Mercure, the Martins, Joseph Daigle, Pierre Duperré and others who had been employed as couriers between Fort Howe and Quebec had in the course of their journeyings become familiar with the fertile intervales of the Madawaska region. The first step in the way of settlement there is seen in a letter of Haldimand to Parr which was written, be it remembered, before the disbanded troops had made any attempt at settlement above St. Anne.

Quebec, 27 Nov. 1783.

Sir,—Mercure the Acadian, who came lately into this province as a guide to Mr. Bliss, having informed me that many of his countrymen wished to emigrate into this province for the sake of enjoying their religion with more liberty and less difficulty in procuring priests, I have thought proper to communicate the idea to your Excellency that in case you should approve of the measure we should mutually assist in taking steps to carry it into execution. My plan is to grant them lands at the Great Falls on the River St. Johns, which in time

may form settlements to extend almost to the River St. Lawrence, which will contribute much to facilitate the communication so much to be desired between the two provinces, and which may be attended with circumstances very favourable for their mutual interests.

I shall be glad to have your opinion on this subject, and have the honour to be, with great regard,

Your Excellency's most obedient
and most humble servant,
FREDERICK HALDIMAND.

The boundary between Quebec and Nova Scotia was at this time supposed by Haldimand to be at the Grand Falls. Carleton and his Council were not disposed to accept a boundary so far south as this. Consequently there was some uncertainty as to which province had jurisdiction over the region of Madawaska. The letter of Mercure to the Surveyor general of Quebec, which follows, may be regarded as the sequel of Haldimand's letter. Mercure seems to have thought that if the Acadians went to Madawaska they would be under Quebec jurisdiction. His letter is given in translation:—

River St. John, 24 February, 1785.

Sir,—I have the honour to write you this letter to assure you of my very humble respect and at the same time to desire you to have the goodness to inform Monsieur Duperré if it is possible for us to have some land below the Madawaska.

In view of the difficulties that exist on the River St. John on account of the new settlements, Monsieur Duperré and my brother and I are resolved to go early in the spring and settle ourselves at that place, if it is possible to obtain grants of lands.

For my own part, Sir, I have the honour to tell you that I have managed my affairs very well. His Excellency the Governor has done me full justice. But seeing so much difficulty ahead on the River St. John and so much miserable dissipation, I do not want to remain at the place.

Monsieur Duperré will speak to you in the interests of the French at this place.

I conclude, hoping to see you sir,

I am your very humble servant,
LOUIS MERCURE.[1]

To Monsieur Holland.

Mercure incloses in his letter a list of twenty-four persons who are applicants for lands. The lands are described as situated "one and a half miles below the Falls of Madouwaska." The applicants were Louis Mercure, Michel Mercure, Pierre Duperré, Jean Lizotte, Pierre Lizotte, Joseph Lizotte, Augustin Dubé, Jean Martin, Joseph Daigle, Joseph Daigle, jr., Daniel Gaudin, Simon Martin, Amand Martin, Paul Cyr, François Cyr, Joseph Cyr, Pierre Cyr, Baptist

[1] The writer received a copy of this interesting letter from the late Prudent Mercure, who received it from Placide P. Gaudet of the Department of Canadian Archives to whom obligation is expressed.

Cyr, Firmin Cyr, Alexandre Ayotte, Robert Fournier, Louis Saus-façon, Joseph Cyr, François Martin. Of the number sixteen were Acadians and eight Canadians.

The co-operation of Louis Mercure, an Acadian, and Pierre Duperré, a Canadian, was well conceived. Both were men of good natural ability and of fair education and together they were able to negotiate equally well with the authorities of Quebec or with those of New Brunswick. As the latter province claimed jurisdiction on the Upper Saint John an application was submitted to the New Brunswick authorities by Joseph Daigle in behalf of the same twenty-four Acadians. This was considered by Carleton and his council, June 21, 1785, and the decision endorsed on the memorial reads: "They will be allowed to sell their present improvements to the best advantage, together with the lands reserved for them, and titles will be given to the purchasers. Mercure has permission to settle the Petitioners on the lands they may chuse at the Madawaski and a grant will pass in due time for 200 acres to each head of a family with the usual front of 60 rods." The names of the applicants are identical with those in the application made at Quebec.

Carleton and his council agreed "that the lands between the Madawaska and rivière blanche, or White River[1] should be reserved for the proposed French settlement." A second step in the establishment of the settlement is referred to in Mercure's letter to Governor Carleton which follows:

Madawaska, 15th September, 1786.

May it please your Excellency,—As it appears that there are here several young people from the age of 16 to 25 years who desire to have lands at this place, I pray your Excellency to give me leave to assign lands to them in like manner as to fathers of families on condition that they improve them. Also to be informed by your Excellency if I am permitted to assign lands to those who desire to settle here who are coming from Canada. In favouring me with a reply as soon as convenient you will much oblige one who has the honour to be,

Your Excellency's very humble
and very obedient servant,
LOUIS MERCURE.

In reply the Governor and Council state that any French inhabitants who desire farms at Madawaska must send in their applications in the usual manner. This was done and the applications having been approved an order of survey was issued. Lots were laid out on both sides of the Saint John from the mouth of the Madawaska to Green River, a distance of nine or ten miles. Before the lots were surveyed the Acadians had entered into possession and marked the fronts of their lands in their own crude fashion. This suffices to explain the

[1] This should read "rivière verte or Green River."

comment made by Surveyor General Sproul in the plan of the settlement in the Crown Land Office in Fredericton:—"The tracts represented on this plan being subdivided into lots by the Settlers and considerably improved before an actual survey was made, the irregularity of the measurement of the fronts of the lots could not be altered without great injury to the settlement."

That the government followed the fortunes of the Acadians with interest and was desirous of doing justice to all concerned is clearly shown in a letter of the Provincial Secretary written at this time.

Fredericton, 14th July, 1787.

Dear Sir,—When I met you on your way to the Upper regions I forgot to mention the settlement forming at Madawaska by a number of French people, partly from this neighbourhood and partly from Canada. They have in general terms been directed to settle themselves in the most convenient manner, so as not to interfere with improvements made prior to their respective settlements.

A license of occupation was given to a number of these people, whose beginning of cultivation and allotment were reported by Lewis Mercure—and these had a promise of a grant as soon as a regular survey could be obtained of the Lands. At the same time I apprehend that those who have made or are making settlements in that District, though not named in the License of Occupation, are not the less entitled to the protection of the government.

I take this opportunity (as I have not the means at present to get an order in Council on the subject) to recommend it to you, while you are on the spot, to direct your deputy, or if necessary to authorize some disinterested person in whom you can confide, to make such a survey as you may find equitable and such as you can return to be laid before the Governor in Council, in order to prepare the way for confirming each man by a grant of the land to which he may be found fairly intitled.

I the rather take this liberty, which I am sure you will forgive, because I find reason to suspect there has been some little maneuvring on the part of my friend Louis Mercure, and others among the settlers, to obtain allotments fronting on the River in such direction as to take in ground actually in possession and in some degree improved by earlier adventurers in that quarter.

You will perceive that I write in haste, but your own observation on the spot will enable you to fix everything properly and with impartial precision.

I am dear Sir, &c., &c.

JONATHAN ODELL.

George Sproul, Esq., Surveyor-general.

The survey of the settlement must have been completed soon after this, and the names of those who had applied for lots were duly registered in conformity with the plan of settlement prepared by the surveyor-general.

Carleton's continued interest in the settlement is evident. He wrote Lord Grenville, under date October 1st, 1790:—

"Many settlers within the last three or four years have made flourishing settlements upon lands lying on the upper parts of the River Saint John, and which till then had remained altogether in a wilderness state. The uppermost

of these settlements has been made by a number of Acadian families who, having sold the small tracts on which they had formerly resided in several parts of the province, petitioned for allotments on the River Saint John, about thirty miles above the Great Falls and a little below the entrance of the River Madawaska, where a tract of 16,000 acres has accordingly been surveyed and laid out for them, and the greater part of it has already been granted in lots of 200 acres each to no less than fifty persons, mostly heads of families, who are actually settled on their lands and have made considerable progress in cultivation and improvement.

These Acadians, finding the district wherein they are settled had been lately supposed to fall within the limits of the province of Quebec, have applied to me by memorial expressing their concern at this suggestion and praying to be continued within the jurisdiction and under the protection of this government. On this occasion therefore I beg to say that I think it would be highly inexpedient to break the chain of settlements now forming on the River Saint John by placing them under different jurisdictions, especially as their local situation gives them all a much greater facility of communication with the seat of Government here than they would have with Quebec."

One more bit of documentary evidence may be added to show the mutual relations existing between the Lieutenant Governor and the Acadians. This is a petition submitted by Pierre Duperré in behalf of the Madawaska people in a time of great dearth:—

"May it please your Excellency and Council:

Your Petitioner humbly sheweth: That your Excellency's French settlers at Madawaska are at present in a most distressed and lamentable situation, upwards of thirty families having not a morsel of provisions of any kind to put in their mouths, their children and wives starving, and so impoverished as not to be capable of assisting themselves even in doing the lightest work, one supposing he may have bread till the first another till the tenth, and but very few until the fifteenth of May.

The above number of families have hitherto been supported by their neighbours, who have given them all they can spare. And this great distress is not owing to much so their own fault as to the severe frosts the last season in the settlement. Meat or fish they have had none this long time, and what they will do God only knows.

However, relying on your Excellency's goodness, prays your Excellency (and Council) will be pleased to take their miserable condition under consideration, to whom they look up as their Father and Protector, and send them such relief as you in your wisdom and goodness may judge best to relieve their immediate necessities.

And your petitioner as in duty bound will pray, &c., &c.

(Signed) P. DUPERRÉ.

Fredericton, 1st May, 1797."

We have now to discuss the statement of the Abbé Casgrain that the American Loyalists and disbanded soldiers were permitted to "sit down at the tables of the Acadians, to eat of their bread and become from henceforth rulers and masters of the lands that had been

bedewed with the sweat of an outlawed race." The passage from which these words are taken intimates that the Acadians were robbed of their lands by the Loyalists without receiving any compensation.

To this it might be answered that, strictly speaking, the Acadians never owned these lands. Few of them had even a license of occupation. Nevertheless the government of Nova Scotia decided that the Loyalists who had drawn the lots on which the Acadians had made improvements must pay for them before they received their grants. Some of the claims for compensation are filed amongst the government records and are quaintly expressed. The following is a specimen:—

"Francis Sear's claim on account of damages sustained from John Coombs.

Upper french Village the 31 July, 1788.

An accompt of Dammage.

To 1 Dwelling house 22 feet long & 20 broad having in it and on it 150 Boards	£37. 10. 0
To 1 Barn 42 feet Long 24 broad having in it and on it 130 Boards & Plank	25. 0. 0
To 1000 Rails	1. 5. 0
To the youse of my 200 feet of Land 1 yeare	2. 10. 0
	£65. 5. 0

(Signed) francis Sear

The lot occupied by François Cyr, in the drawing of lots by officers and men of the 2nd New Jersey Volunteers, fell to Lieutenant John Coombes, who was called upon to pay for the buildings and other improvements made by Cyr.

As Cyr is reported by Major Studholme's Committee as having been fifteen years on his land and as having a wife and ten children, it would have been a hardship if he had been dispossessed. But he was not. His name occurs in the list of those who in 1785 petitioned the New Brunswick government for lands at Madawaska and he removed there before Lieut. Coombes entered into possession of the lands formerly occupied by him at the Upper French Village eleven miles above St. Anne. Coombes was obliged to pay for the improvements made by Cyr.

Not only did the Acadians receive compensation, but in various instances those who desired to continue on their old locations were included along with the Loyalists in a general grant and thus a clear title was obtained. If in such a case an Acadian found himself placed between two Protestant proprietors, it does not strike the ordinary Canadian of to-day as a very great enormity. Take the case of the lands at French Village on the Kennebecasis. Carleton wrote to Lord Sidney concerning them on July 4, 1787, stating that the Aca-

dians had formed a scattered village there many years since and that they had repeatedly received the notice and protection of government. Unfortunately they were without a grant of the land on which they had settled, but opportunity had lately been taken to confirm them in quiet possession. The minute in Council relating to the matter reads as follows:

> "Warrant to issue to the surveyor Gen'l for laying out all the unsurveyed part of the Land granted to Sir A. Hamond, now escheated, the same to be laid out in Lots of 200 acres each fronting on both sides the new road on Hammond River and the Kennebecacius. That part of the Tract in the possession of the French Inhabitants to be laid out so as to include their Improvements and to allot thereto two hundred acres each if the situation will admit."

A grant was accordingly made to thirty-seven grantees and the Acadians, François Violet, Joseph Theriault,[1] Olivier Thibodeau, Charles Blanchard, Jean Blanchard, Jean Baptist Denoyer, and Jean Robicheau were included.

A French settlement at the mouth of the Keswick on the River St. John, above St. Anne, had been made with little order. The Acadians, perhaps, had been so frequently driven from their locations in the past that they were not very particular in laying out their farm lots. Their small settlement fell within the tract assigned to the Royal Guides and Pioneers. It was in the vicinity of the place known as Crock's Point.[2] The people being desirous of procuring a title to the lands they had occupied and improved entered into the following agreement:

St. John's River, 18th Oct'r, 1784.

> Agreement made and concluded on jointly between Peter Tibeto, Joseph Cyr, Fearmon Cyr, Olivier Tibeto, John Tibeto, Olivier Tibeto jr., Alex. Cormier, Baptist Cormier, Jacob Cormier, Peter Cormier, Amand Cormier, Peter Cormier, jr., Francis Cormier and Joseph Cormier,[3] that on consideration that they receive the grant of the tract of land that they at present occupy, every one of the above mentioned shall possess the same lot he is at present in possession of, and it is further agreed that a certain piece of vacant land lying amongst the whole shall be divided to such of them having the smallest lots to make them equal with the rest."

[1] Joseph Thériault addressed a Memorial to Governor Carleton on Aug. 2, 1785, in which he states that having by him materials for a Grist-mill and being solicited by all the settlers on the Little Kenebacasius (or Hammond River) to operate the same he proposes to do so if he can obtain "the favor of setting it on a vacant Stream near Darling's Island; it will be of the greatest benefit to every settler they having no other conveniency than a hand mill." The memorial is endorsed by eleven of his neighbours, all English speaking people.

[2] An Acadian named Cyr lived here. The Cyr family received the sobriquet of Crock; hence the name "Crock's Point."

[3] The spelling of names is as in the original document.

This agreement was signed by the Acadians, each making his *mark*, in the presence of Augustin Le Blanc and Joshua Naylor. In a subsequent memorial the signers explain that they had settled on their lands promiscuously, but finding that there was likelihood of a grant they entered into the above agreement and asked that the tract above the Keswick stream be granted to them as a company of settlers, the government indulging them with the liberty of dividing it among themselves according to their mutual agreement. The petitioners state that they are induced to enter their plea in consequence of his Excellency's benevolence to the Acadians living below the Keswick stream in giving two hundred acres of land to each settler. It was agreed in Council that the memorial be complied with.

The settlers referred to as living on the river below Keswick were Maturin Gautreau, Pierre Mazerolle, Alexis Thibodeau, Joseph Roi, Louis Lejeune, Baptiste Vienneau, Baptiste Daigle, François Gaudin, Pierre Pinette, François Hébert, Maturin Mazerolle, Paul Mazerolle. Their locations were opposite Sugar Island and Savage Island and were interspersed among the lands granted to the Prince of Wales American Regiment. They were included as grantees in the grant made to that corps on the 15th October, 1784.

Farther down on the same side of the Saint John were lands for which Augustin Le Blanc submitted a memorial on the 24th November, 1784[1] It was resolved by the Governor in council that an assurance be made in writing that each inhabitant shall have 200 acres surveyed to him; the said allotments to extend in front on the river 40 rods where the situation will admit of it, in other cases the front taken up to be equally divided between the occupants, and that grants should in due time pass for the same.

Any one who reads the minutes of the proceedings of the Governor in Council will be struck with the number of instances in which the interests of the Acadians were considered. In many cases the matters discussed were not of great importance, but they were patiently dealt with and in a spirit of fairness. As an example let us take the matter complained of in the following memorial:

> "To His Excellency Thomas Carleton, Captain General and Governor in Chief, &c., &c., &c.
>
> The Memorial of Amand Cormier and François Cormier most humbly sheweth—
>
> That your memorialists about sixteen years ago settled on a vacant tract of land on the River of St. John where they have resided ever since; have each built a house & barn, cleared, improved & cultivated a considerable quantity of land.

---

[1] This memorial has already appeared in this paper, see p. 419 *ante*.

About two years ago Lewis Mitchell [an old settler] brought a suit of ejectment against them, when it was determined by the jury, which tried the cause, that he had no right or title to the land they occupy. Thus circumstanced the memorialists with the other French Inhabitants living on the north side of the River St. John made application to his Excellency for grants of their present possessions, to which they received the most favourable and satisfactory answer. . . . .

They conceive it a very great hardship to be put to the expence of sending such a distance to support their claims to said lands. They pray that Mitchell[1] shall pay them for their trouble and expence provided it appears to your Excellency that his claim is groundless and vexatious.

Dated at Parr Town, 5th April, 1785.

(Signed) AMAND CORMIER,
FRANCOIS CORMIER.

The Cormiers lived at this time on the north (or east) side of the Saint John, two or three miles above St. Anne's Point. Two of the lots improved by them were purchased in 1786 by the Rev. Samuel Cooke, rector of Fredericton, and Lieutenant Anthony Allaire of the Loyal American Regiment. Two other lots were sold to Lieutenant George Lambert of the 3d New Jersey Volunteers.

Another member of the Cormier family sold his improvements to one Zachariah Sickles. The method employed, where the Acadian settler had not obtained from government a title to his land, appears in the memorial which follows:—

"To His Excellency Thomas Carleton, Esquire, Governor, Commander in Chief, &c., &c., &c.

We the subscribers having sold our land and all our right, title and property therein for a certain consideration, wherewith we are fully satisfied, contented and paid, Pray your Excellency will be pleased to grant the same in the name of Mr. Zachariah Sickells to whom we have sold as it now lies, being number thirty at the entrance of the Madamkeswicke river.

(Signed) JOSEPH CORMIER,
MARY CORMIER.

Witness, Monson Hayt.

Fredericton, June 30, 1787."

Memo. Zachariah Sickles asks a grant of Lot No. 30 at the mouth of the Madamkiswic[2] which he has purchased of Joseph Cormier.

[1] Lewis Mitchell was well known on the St. John River, and during the Revolutionary War had rendered important service to the British. He claimed possession of 250 acres "near the French Chapple on the West Side of the River and 400 acres on the East Side near St. Anns, also an Island called St. Donns (or Sandon) near Oak Park (Aukpaque)."

[2] The Keswick stream is meant. Its Indian name is *Noo-kam-keech-wuk*, of which Madamkiswic ia a corruption.

It has been a matter of surprise to the writer of this paper to find so many instances recorded in which the Acadians received compensation for their improvements. Some of these have been already referred to. A few others may be mentioned, but the time at our disposal forbids any attempt at an exhaustive list.

In a deed of conveyance, dated July 15, 1786, Joseph Thériault and Marie his wife "in consideration of the sum of eighty-seven pounds, ten shillings current money of the province, do grant, bargain and sell unto Frederick de Peyster[1] a certain House and Plantation situated, lying and being on the upper end of Sugar Island, containing by estimation one hundred acres of land more or less." John Murray, Sheriff of York County, and Joshua Upham, Justice of the Supreme Court, were witnesses to the conveyance.

Another document in the provincial archives shows that on the 16th July, 1787, Arthur Nicholson, late a cornet in the Kings American Dragoons, purchased for the sum of twenty-five pounds the improvements of Jean Baptiste Cyr at Crock's Point. The lot contained 200 acres and the quit claim is signed by Cyr and his wife Judy [Judith].

Nicholson also purchased in May, 1786, a lot of 200 acres from Joseph Hébert in the block laid out for the Guides and Pioneers, commencing twenty rods above the Mactuquack Creek on the east side of the River Saint John. He received from Hébert a quit claim in the usual form.

Daniel Gaudin, whose descendants still live in the parish of Kingsclear, near the ancestral hearthstone, was one of those who received compensation for the improvements which he had made on the lands he occupied. His quaint memorial is quoted in full.

> The Memorial of Daniel Godong humbly sheweth that hee is A Old inhabitant in the Loer french Village, that hee Built and Cleard a farm which Colo. Alling [Allen] toald him that hee should have and Secretary Odell toald that hee should have his farme; this Day Capt. Lee has forworned me not to Do Aneething on the Land more.
>
> Your memorialist humbly prays that you Will be so Good as to giv mee my Land that I have improved and not to Let anee other man injoy my Labour and shall Rest as in Duty Bound shall ever pray.
>
> DANIEL GODONG.
>
> Loer french Village the 29 April, 1789.

The Governor in Council ordered that Gaudin should receive one hundred dollars in consideration of the improvements which he had made. The Lower French Village where he lived was nine miles above Fredericton on the west side of the Saint John. The place

[1] Frederick De Peyster was a Captain in the New York Volunteers. For a further account of him see Lawrence's Foot Prints, pp. 60-64.

known as the Upper French Village was about three miles farther up the river.

On June 27, 1788, the Governor in Council discussed the case of Andrew Joslin who had taken up a lot in the block assigned the 2nd New Jersey Volunteers. Joslin stated that he had agreed to satisfy Guimond, the French inhabitant, who was willing to quit his claim to the land for the consideration of fifty dollars. Joslin was informed that he would be permitted to have the lot on producing Guimond's receipt which he did on November 8, 1788.

As early as 1785 a number of the Acadians, living in the settlements above Sainte Anne, submitted a memorial to the Governor in which they desired compensation for the improvements they had made and asked for lands at Miramichi. It was agreed in Council to comply with their request and Colonel Allen and Colonel Winslow were requested to value the improvements and in case of non-agreement to appoint a third arbiter.

So far as documentary evidence can show, Carleton and his council were sincerely desirous of protecting the Acadians from imposition. From the minutes of council for the year 1785 we take for illustration three cases.

Ensign Jonathan Brown, of the Royal Guides and Pioneers, asked leave to exchange a part of the land he had drawn in the regimental block for land in the possession of Jean Baptiste Cyr. He received for answer, "The prayer of the memorial cannot be granted as it would interfere with the rights of a French Inhabitant."

The widow of Lieutenant De Beck, late of the New York Volunteers, submitted a memorial desiring a grant of 200 acres adjoining the lands of her father, Captain John Althause, near the Keswick Stream. She received for answer that she could have the land provided that the grant would not interfere with Louis Mercure's improvements.

Ensign Nicholas Humphrey, of the New York Volunteers, having made application for 200 acres of land in the same neighbourhood was informed that he could have the lands, if vacant, and the grant did not interfere with Mercure's mill.

The Acadians living on the east side of the River Saint John, above and below the Keswick Stream, all abandoned their lots during the seven or eight years subsequent to the arrival of the Loyalists. Jean Baptiste Cyr, Joseph Cyr[1] and Jean Baptiste Cormier went to

[1] The wife of Joseph Cyr, Blanche Marguerite Thibodeau, was called the "Aunt of Madawaska," or simply "Ma Tante le Blanche." She was aunt to most of the Thibodeaus, Cyrs, Violettes and Theriaults who were amongst the prolific founders of Madawaska. She was a woman of remarkable gifts and her name is proverbial as synonymous with sweetness and goodness.

Madawaska, the others seem in nearly every instance to have gone to Eastern New Brunswick.

Jean Baptiste Gaudin, Alexandre Gaudin, François Gaudin, Antoine Gaudin, Joseph Theriault and Pierre Pinet went to Caraquet, in the County of Gloucester, where a grant of 2,757 acres was made to them on April 25, 1787.

Jean Baptiste Daigle, Baptiste Vienneau, Louis Lejeune, Joseph Lejeune and Joseph Roy, settled at what is now Bathurst Village. Mathurin Gautreau settled at Tracadie.

To Baie des Ouines (now called Baie du Vin) in Northumberland County, there went Joseph Hébert, Jean Hébert, Pierre Mazerolle, Paul Mazerolle, Etienne Quessy, Alexis Thibodeau, Jean Denoyer, Amand Martin, Joseph Doucet and Joseph Martin[1].

To Memramcook in Westmoreland County, went Augustin Le Blanc, Amand Landry, Pierre Cormier, Sr., Pierre Cormier, Jr., Joseph Cormier, François Cormier, Sr., François Cormier, Jr., and Amand Cormier.

Jacques Cormier, Benoit Roy and Francis Hébert settled in Kent County—Hébert at Cocagne, the others at Bouctouche.

The majority of the Acadians who lived on the west side of the Saint John, at the Upper and Lower French villages and elsewhere, in Kingsclear, went to Madawaska. Among the early Madawaska grantees we find the following persons, whose names are mentioned in the report of Major Studholme's exploration Committee in 1783:—Alexandre Ayotte, Jean Baptiste Cyr, François Cyr, Jacques Cyr, Joseph Cyr, Olivier Cyr, Paul Cyr, Pierre Cyr, Jean Baptiste Cormier, François Cormier, Pierre Cormier, Joseph Daigle, Jean Baptiste Daigle, Jean Baptiste Fournier, Joseph Hébert, Jean Martin, Joseph Mazerolle, Louis Mercure, Michel Mercure, Paul Potier, Louis Sausfaçon, Olivier Thibodeau. At least an equal number of the grown-up sons of those named are included among the first grantees at Madawaska. There were in addition about ten grantees who came from French Village, near the Kennebecasis, in Kings County, also seventeen grantees who came from Canada.[2]

[1] Joseph Doucet and Joseph Martin previously lived above Saint Anne on the west side of the Saint John.

[2] The first grant at Madawaska comprised 16,000 acres situated on both sides of the River St. John. There were about 38 Acadian grantees and 12 Canadian grantees. A few of the grantees seem to have had two lots. In the second grant of 5,253 acres, made to Joseph Soucy and twenty-three others on August 2, 1794, there were 19 grantees of Acadian origin and 5 of Canadian origin. In the beginning therefore the Acadians formed rather more than three-fourths of the population. This was afterwards changed by the large immigration which came from Canada, so that to-day the Acadian and the Canadian elements are about equally represented.

As already stated the dispersion of the Acadians of Sainte Anne was a voluntary one. The reasons that led to it we shall presently consider. It was not hurriedly undertaken and the locations selected were sought out by the Acadians themselves. We have already seen that the settlement of Madawaska was established about the year 1785 under the leadership of Louis Mercure, Pierre Duperré and Joseph Daigle. The settlement received an important addition when the Thibodeaus, Theriaults and Violets of French Village in Kings County removed thither. The reasons that inspired these families to seek a new location are stated in their memorial to the Governor. This is in the hand writing of Elias Hardy, of St. John, an eminent lawyer and a member of the Provincial Assembly:

To His Excellency Thomas Carleton, Esq'r., Lieutenant Governor of His Majesty's Province of New Brunswick, &c., &c.

The Petition of Olivier Tibodo, Sen'r., Joseph Tarrio, Sen'r. and François Violet, Sen'r.—humbly sheweth—

That your Petitioners are descended from the early Settlers of Acadia at the time it was under the dominion of France and have been educated in the Roman Catholic persuasion.

That they are at present Inhabitants of a place called the French Village on the little Kennebecasis[1] where they possess small lots of Two Hundred acres each.

That your petitioners are incumbered with large Families for whose settlement in life they look forward with much anxiety and it is their earnest wish to see them settled around them on Lands of their own, which they cannot expect In the part of the Country where they now dwell.

That your petitioners are informed that Government offers encouragement in Lands to such persons as shall settle high up the River St. John, which your petitioners are desirous of doing, not only in order to obtain such lands for their Families, but that they may have the assistance of a Priest in the performance of the rites and ceremonies of their religion and in the superintendance of their children's education.

That having always demeaned themselves since the cession of Acadia to Great Britain as faithful, peaceable and industrious subjects and settlers, your petitioners humbly pray that Lands proportioned to the number of their Families may be granted to them and their childern (a list whereof is annexed) at a place called the Madawascas, between the Seven Islands and the River Verte on the River Saint John. And your Petitioners, as in duty bound shall ever pray, &c.

The mark + of Olivier Tibido, senr.
Witness — The mark + of Francis Violet
E. Hardy. — The mark + of Joseph Tarrio Junr. for his father Joseph Tarrio, senr.

Olivier Tibodo's Family consists of Olivier Tibodo, Senr. His Wife—8 sons named

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By the Ashburton treaty in 1842 that part of Madawaska west of the Saint John was given to Maine.

[1] The stream is now better known as Hammond River.

Olivier, aged	23 years,	Toussant,	15 yrs,
Gregory,	21	François,	9
Fearman,	19	George,	8
Paul,	17	Baptiste,	6

and three daughters—Total, 13.

Joseph Tarrio's, himself & wife & 6 sons.

Joseph,	21	François,	14
Gerard,	19	Simon,	12
William,	15	Lawrence,	8

Four daughters—Total 12.

Francois Violet's, himself & wife & 7 sons.

Augustin.	17	Louis.	10
François,	15	William,	9
Charles,	14	Alexandre,	3 mos.
D'Aubigne,	12	Five daughters, Total 14.	

In the whole 39.

The decision of the Governor in Council is tersely endorsed on the memorial "May sit down on vacant lands and report their situation, which will be secured by proper grants." The memorial was considered in Council December 24, 1789.

As a further proof of the kindly feeling of the provincial authorities towards the Acadians we shall quote the letter addressed by Jonathan Odell to Surveyor-general Sproul, written about the same period.

Dear Sir,—The bearer, John Robicheau from Kennebecasis, having only 100 acres in that district and being incumbered with a wife and eight young children wishes to settle at Madawaska. I have therefore sent him to beg information from you, whether in your opinion we can between us encourage him with expectations. I take it for granted that the Governor and Council would approve of this man's obtaining an establishment where he wishes, if it can be done without either incommoding the Acadians who are gone thither before him, or deranging a plan that might perhaps be found to require room for another Settlement in the same part of the Country. I believe this poor man is distressed, and if you think we can with propriety console him with a promise to recommend him to the Governor and Council for a lot at Madawaska it would be agreeable to your humble servant,

JONATHAN ODELL.

30th June, 1789.

The surveyor-general in his reply stated that he quite agreed with the provincial secretary and if Mr. Robicheau had decided to settle at Madawaska his request for lands should be complied with.

Not all the applications in behalf of the Acadians were expressed in such excellent phraseology as that of Elias Hardy and Jonathan Odell, nevertheless they appear to have received equally favourable consideration. The following memorial is a case in point.

To His Excelency Thomas Carlton Esq. Capt Genl & Governor in & over the provence of New Brunswick & its teratories theirunto Belonging &c., &c., & His Honourabel Counsel.

> the Memoriel of Wee whos names is heer Unto signed Humbly pray that your Excelency Will Be pleasid to Give to us Land joyning to Carrecut Village to Begin at the Loerend of Ollever Lashear Mash and so to run Up a Long Said Marsh for Eight famelys, as Wee Would Wish to forme a french Village as We are Assurid of a Chaplin as Soon as their is a few Moar famelys Settelid their and Wee as in Duty Bound shall Ever pray.
>
> (Signatures) Joseph tareyo, John Batist tareyo, peter tareyo, Victoar tareyo, francis tareyo, Domeneck penet, peter penet Juner, francis Corme.[1]

This memorial is dated at Sugar Island, June 30, 1786. The memorialists were assured by the Governor in Council that they might "go and sit down and report their situation." Accordingly they went and "sat down" beside a colony of thirty-four French families on the south side of Caraquet Bay where, on the 25th of April, 1787, they received from government a grant of 2,757 acres.

Those of the Acadians who remained at their old locations above Fredericton, in the course of time became so largely identified with the surrounding English speaking people as to lose their national characteristics. To-day they do not understand the language of their ancestors and have intermarried to some extent with the English. For some years they had neither resident missionary nor schools. The lack of these refining and christianizing agencies proved detrimental to their manners and their morals, but lately there has been a marked advance in their condition.

Both the religious and national instincts of the Acadians are strong. When the proposal to removal from Sainte Anne was first mooted by Louis Mercure, in his interview with General Haldimand in 1783, he stated that many of his countrymen wished to emigrate into the province of Quebec for the sake of enjoying their religion with more liberty and less difficulty in procuring priests. Doubtless the coming of a multitude of English speaking people among them, more especially the disbanded troops, was unwelcome. They wished to live undisturbed and to retain the customs, language and religion of their ancestors. A combination of circumstances led to their resolve to establish themselves elsewhere. They were not driven forth by the provincial authorities and they might have remained on their locations had they wished to do so. It is not unlikely, in that event, that they would, in the course of time, have become so intermingled with the English that they would ultimately have become one people. This would have involved the loss of their mother tongue and some of their national characteristics. Their priests feared that it might also have interfered with their religious faith. Whether it would have

[1] This memorial seems to have been written by some illiterate English Settler, probably one of the disbanded soldiers. The Acadians had long been deprived of every educational advantage; at this time few could read or write.

been in the best interests of New Brunswick that the two races should have coalesced so as to form a united people, speaking one and the same language, is a matter that we need not here discuss.

It has been the object of this paper to show that Governor Carleton and his council endeavoured to deal kindly and justly with the Acadians. But they were probably quite willing that they should remove to another part of the province where they would not interfere with the continuous settlement of the lower Saint John by English speaking people. The Governor's interest in their welfare however, did not cease with their removal to remote situations, and a token of his continued interest is found in a letter to General Prescott, Governor of Canada, written in 1798, in which he says:—

> "There is resident in this Province in the County of Northumberland, a district bordering on the Province of Lower Canada, a Mons'r. Castanet, a missionary appointed by the French Bishop of Quebec to the Acadians and savages of that district, of whose character and conduct I have received very favourable reports from the principal magistrates of the country, and I therefore beg leave to recommend him to your Excellency as deserving of such countenance and encouragement as may be allowed to other loyal and useful Missionaries in similar situations."

The letter of the missionary to Carleton will be found in the appendix to this paper. It breathes the language of friendly regard. The governor left the province five years later. Since his day the Acadians have multiplied amazingly and have attained a position in the province of which neither Thomas Carleton nor his Council had at the beginning of the last century the faintest conception.

APPENDIX.

Lettre de R. P. J. Castanet à Lt.-Gov'r. Carleton.

Caraquet, 8 Janvier, 1798.

Monseigneur,—L'été passé j'eus l'honneur de présenter mes hommages à votre Excellence, et je me sentirais encore entrainé à fredericton pour m'y acquiter du même devoir, si le foible état de ma santé présente ne m'arrêtait. Je ne trouverais en éffet rien de plus flateur que d'aller, Monseigneur, vous présenter tous les ans le juste tribut de mes respects et de mon obéissance.

L'objet de cette lettre n'est pas de solliciter de nouveau une pension. Je suis très convaincu, Monseigneur, de ce que vous me dites, qu'il n'était pas en votre pouvoir de rien faire pour moy à cet egard, mais vous eutes la bonté d'ajouter que vous pensiez que mes

services etaient dignes de recompense. Je demanderais donc qu'il plut à votre Excellence de m'accorder une récommendation auprès de Mylord Prescot qui est disposé à me favoriser du même traitement que les autres Missionaries, si toute fois votre Grandeur veut attester qu'elle m'en croit digne. J'ose ésperer, Monseigneur, que vous ne refuserez pas de vous intéresser pour moy quand vous penserez de nouveau, qu'avez une mission pauvre, fatiguante, et nombreuse (349 familles). Je suis le seul de tous les missionaires du Canada qui ne reçois rien.

Qu'il me soit permis de joindre mes voeux particuliers, à ceux que font les habitans de ces côtes pour la prosperité de votre Excellence.

J'ay l'honneur d'être avec un profond respect

Votre très humble

très obéissant et

soumis serviteur

J. CASTANET, Pte. My.

SAINT JOHN RIVER, above SAINTE ANNE

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SECTION III

SERIES III JUNE 1914 VOL. VIII

PRESIDENTIAL ADDRESS.

By R. F. STUPART.

Delivered May 26, 1914.

As it is now thirty-two years since a Meteorologist has had the honour of holding the office of President of Section III, it is perhaps not surprising that I should seize this opportunity of speaking a word for the Science which deals with the weather and weather changes. I know indeed that there are scientific men who, while prepared to recognise Meteorology as a Science, in as far as it is based on exact observation, consider that the Meteorologist has sinned greatly in wandering into empiricisn. They regard weather forecasts as unscientific as they are deductions based on insufficiency of data. There is certainly some ground for such an argument, but on the other hand those most closely interested in results are not dissatisfied with the success achieved in the warnings of coming storms, which have without doubt saved many lives and an enormous amount of property.

The Governments of all the civilized countries have for nearly forty years maintained Meteorological Services, and without exception, all have found it necessary to publish weather forecasts. Many trained mathematicians have been engaged in the work in both Europe and America, and yet to-day it is generally acknowledged that the successful forecaster is not necessarily a mathematician, but a man who began the study of weather maps when young and possesses a special aptitude for the work.

The earth's atmosphere being a whole, no part of which is ever quite at rest, and the greater part in rapid motion, the entire circulation is of extraordinary complexity, and as yet, many of the factors which control the mechanism are unknown. These unknown factors will, however, diminish in number with the progress of solar physical research, and the exploration of the atmosphere, and it is probable that long range forecasts, as to the character of the coming season, will some day be made on a purely scientific basis.

It is my belief, however, that the daily forecasts will always be more or less empirical.

As the atmosphere knows no national boundaries, international co-operation in research is indispensible, and as far back as 1872, an International Congress of Meteorologists was held in Leipzig and others at periods of about five years have since been held at various

European centres. The result has been a common system of observation over the whole globe, and fruitful discussions of Meteorological phenomena, which in their varying form are manifested over the entire earth.

Following the systematizing of observations at ground level, a system for the exploration of the atmosphere by kite and balloon has been gradually taken up by the various countries until I believe it is now a fact that all the civilized countries are doing something to assist in the work. The necessity of obtaining upper air data was recognised very many years ago by Glaisher and others who made many balloon ascents for purely scientific purposes, but probably the two men who have done the most were M. Teisserenc de Bort of France and Lawrence Rotch of the Blue Hill Observatory near Boston, the former being especially identified with the inauguration of the system of unmanned balloons carrying registering instruments and the latter of the kites, also carrying instruments.

There is now an International aeronautical Committee, which arranges the dates and times at which balloons are to be sent up and attends to the publication of results which are thus made available to all engaged in meteorological investigation.

Canada first took part in the Upper Air work in February, 1911—since when 78 balloons have been despatched and 44 have been returned with records of pressure and temperature.

The following are some of the facts:

1. Only three balloons have been found west of the point of departure, and these instances occurred during a period of fine weather and high barometer at midsummer; the great majority travelled in directions between EN.E. and SE.
2. The height reached by the balloons in winter is not as great as in summer, this average being as 12: 15.
3. The isothermal layer or stratosphere is at a lower level in winter than in summer, the average height being 10.1 kilometres in winter and 13.4 in summer.
4. The stratosphere has a lower temperature in summer than in winter—the average of 11 flights in summer showing $-62^\circ{\cdot}3$ and 12 flights in winter showing -59 C.
5. The stratosphere is found to be warmest when the balloon flight is in the same direction as a strong surface wind.
6. Somewhat meagre data seems to indicate that the stratosphere is coldest when the surface pressure is nearly uniform over a large area.
7. The longest balloon flights have been just prior to the development of great storms and the flights have been nearly in the direction of the subsequent storm movement.

These records present some particularly interesting features as the results lie between those obtained in Northern Europe and in the equatorial regions.

The general form of the annual curve shewing the height of the stratosphere in Canada, is fairly in accord with that of Northern Europe, it being lower in winter than in summer and autumn, but the range is larger. Then the curves showing the annual variation in temperature differ quite widely, the lowest temperature occurring in Europe during the winter and in Canada during the summer. The mean temperature of the statosphere over Toronto is several degrees lower than in Europe. These results point to latitude as a factor as the stratosphere over the Equator is at a higher altitude and some 30° colder than in middle latitudes. A temperature of –133° Fah. was obtained from an instrument sent up from Batavia on Nov. 5th, 1913.

Observation has shown that the most stable barometric conditions on the surface of the Globe are those of the sub-tropical belts of high pressure over the oceans, in both hemispheres, which while they wax and wane and also change their position with the sun's declination, are fairly persistent throughout the year, and together with a belt of relatively low pressure around the Globe in the equatorial regions are closely associated with the trade winds on both sides of the equator. It is generally allowed that these belts of high are largely the outcome of the overflow from the hot expanding atmosphere of the equatorial regions, and perhaps it is not an unlawful assumption that the primary distribution of atmospheric pressure is a belt of relatively low pressure around the Globe in the equatorial regions or more properly near the thermal equator; a belt of high between latitudes 30 and 40 in both hemispheres and then a lessening pressure towards higher latitudes and the poles.

Impressed on this primary system is another which is clearly the outcome of the large range in temperature between winter and summer over continental areas and the comparatively equable temperature of the oceans. Over Asia and eastern Europe during the winter the weather becomes very cold and contraction in the lower strata of the atmosphere leads to a lowering of the barometric surfaces, a consequent increasing flow of air in the upper regions from the tropics to higher latitudes intensifying the normal high pressure belt and causing an extension of marked anticyclonic conditions into the central and more northern portions of both Asia and Europe.

In summer the converse obtains and the heating up of the continent leads to expansion of the overlying air and the thermal equator is transferred to southern Asia, and the sub-tropical belt of high dis-

appears or may perhaps be considered as existing in a modified form over Northern Asia. The changes in the distribution of pressure over the North American continent are of the same type as over Asia and Europe.

In the Southern hemisphere where the land areas are smaller, the primary system of circulation is less affected by a secondary system, the sub-tropical belt of high pressure is more pronounced and persistent, resulting in a more regular atmospheric circulation than in the Northern Hemisphere.

In 1903, at the meeting of the B.A.A.S. at Southport, Dr. H. H. Hildebransson read a paper on the general circulation of the atmosphere touching more particularly on the knowledge derived from cloud movement, and from the earlier balloon records obtained by M. Teisserenc de Bort. The paper was short and stated with wonderful clearness the conditions as we know them today after another ten years of upper air exploration by kite and balloon.

Dr. Hildebransson summarises his paper as follows:

1. Above the thermal equator and the equatorial calms there exists an easterly current throughout the year.
2. Above the trades there prevails an anti-trade from S.W. over the Northern Hemisphere and from the NW. over the Southern Hemisphere.
3. This Anti-trade does not pass the Northern limits of the trade wind. It is deviated more and more to the right over the Northern Hemisphere and to the left over the Southern Hemisphere to become a current from the west above the crest of the barometric maximum of the tropics where it descends to augment the Trades.
4. The entire zone of trade winds changes position with the seasons, moving northward and southward with the changing declination of the sun, but through a smaller angle.
5. From the tropical high pressure the atmospheric pressure diminishes continually towards the poles—at least beyond the polar circles. Thus the air of the temperate zone is drawn in a vast polar whirl turning from W to E. The turning movement seems to be of the same nature as that of an ordinary cyclone; the air of the lower strata approaches the centre and that of the upper layers departs more and more from it with height above the earth's surface up to the highest altitudes of which we have information.
6. The strata of upper air of the temperate zones spread out above the high pressure of the tropics to descend there.
7. The irregularities found at the earth's surface, particularly in the regions of the monsoons of Asia, disappear in general at the height of the lower or intermediate clouds.

We have then a general knowledge of some of the phenomena of atmospheric circulation which lead to normal pressure distribution over the Globe, but we are as yet almost wholly ignorant of many of the factors which lead to disturbances which occur as cyclone and anti-cyclones in the higher latitudes. We do know, however, something of the conditions which are very obviously connected with the development of cyclones—perhaps indeed we have more certain knowledge regarding this than of any other meteorological activity, *e.g.*, in the colder seasons when cold continental winds in the rear of a shallow trough of low pressure reach the coast line of the Gulf of Mexico or the Middle Atlantic, there is almost certain to be a marked storm development with heavy precipitation. Moist warm air of the Gulf Stream on one side and cold dry continental air on the other lead to a rapid cyclonic development and the greater the contrast in temperature, the more pronounced will be the storm. The conditions leading to anticyclonic development are not so clearly defined and observation of weather maps does not shew with any degree of conclusiveness what particular conditions lead to the formation of the travelling anticyclones which move southeastward across the Canadian Dominion.

There is, however, reasonable ground for belief that the North American anticyclone, at least in its initial stages, like that of Asia, is largely the outcome of the cold of radiation which in the absence of marked cyclonic conditions impinging on the Pacific coast, produces low temperature and increasing pressure in the higher latitudes.

The daily reports now received from Great Britain, North Europe and Iceland, in one hemisphere, and those from Canada and Alaska in the other hemisphere, render it possible to draw the isobars with a fair degree of accuracy about the two great centres of cyclonic action in Atlantic and Pacific and by interpolation it is possible to deduce with but a small margin of doubt the run of the isobars over the polar sea.

The charts prepared with this data show pretty conclusively that some of the anticyclones which move over North America are of Asiatic origin. There are others, however, which very obviously develop as they move southward from the Mackenzie river territory, and others again which come in from the Pacific in middle latitudes. These several movements are each characteristic of different types of seasons and could we solve the problem of the construction of these anticyclones a long step in advance would be made towards forecasting seasons.

But there are some glimpses of light on the subject and no better examples of the conditions which lead to a complete cutting off of Siberian highs and the lack of highs in the far N of Canada—can be

shown than those which occurred during the first two months of the past winter. Inspection of maps of mean atmospheric pressure show that during both December and January the cyclonic areas in both Pacific and Atlantic were abnormally pronounced and those in the Pacific encroached to an unusual degree into the region constituting Northern Alaska and the Yukon.

Now I have before stated that we do know something of the conditions most favourable for cyclonic development on the eastern coast of America and it is permissible to assume not only that somewhat similar conditions lead to cyclonic development on the east coast of Asia, but further that any increase in the warmth of the ocean currents will lead to intensification of the cyclonic areas.

The Canadian Service now has under investigation the question of possible changes in the temperature and position of the ocean currents in both Atlantic and Pacific. From time to time it is reported that the warm waters of both the Gulf Stream and Japan current are found further north or further south than normal and there seems to be good foundation for such reports. Any variation in these is probably due to the variations in the strength of the Trade Winds during previous months.

In Nature, 1905, Dec. 21, Dr. W. N. Shaw finds connexion between the strength of the Trade winds at St. Helena and the rainfall of England. It seems a reasonable hypothesis that the connexion is through the medium of the ocean currents.

It is an established fact that the Trade winds of the tropics do vary in average strength from year to year and this variation will certainly be in agreement with variations in barometric gradient: whence this change? It is only within the past few years that observation has proved that the solar constant is a variable. Dr. Abbott in his address before the Philosophical Society of Washington on January 3rd, 1914, says—"During the whole solar constant campaign from 1902 to 1913, about 700 measurements of the solar constant of radiation have been obtained, all but three of the values ranging between 1.80 calories and 2.10 calories. The range of these numbers is mainly attributable to the actual fluctuation of the sun itself, though part, especially in Washington work, is due to accidental errors of measurement. The mean value from 690 measurements is 1.933 calories per square centimetre per minute. It is believed that this number represents the average value of the solar constant of radiation for the epoch 1902 to 1913 within 1 per cent."

"Besides the short irregular fluctuation of solar radiation above mentioned as having been shown by the simultaneous measurements at Mount Wilson and Bassour, Algeria, it appears that a long period

fluctuation is associated with the sunspot numbers. This connection is brought out by taking the mean monthly values of the solar constant measurenents at Mount Wilson from the year 1906 on, and comparing them with the mean monthly sunspot numbers of Wolfer for the same period. From such a comparison it appears that the greater number of sun-spots the higher will be the solar constant of radiation, and that an increase of a hundred sun-spot numbers corresponds to an increase of about 0.07 calories per square centimeter per minute in the solar radiation outside the earth's atmosphere."

We then have a varying solar radiation and this must to some extent affect the temperature conditions of the earth.

It is a warrantable inference that the equatorial region where the rays strike most directly will repond most quickly to radiation changes.

It will be of interest to you to learn that in the very near future all the British Meteorological Charts will be published in absolute units. The pressure in millibars and the temperature in centigrade degrees above absolute zero. The northern hemisphere charts published in both England and the United States are already in this system, and just as soon as the reports from Europe are telegraphed to Canada in absolute units, just so soon will our working map be prepared in those units as I am sure we shall find not the slightest inconvenience in their use for the preparation of forecasts.

Modern Views on the Constitution of the Atom.

By DR. A. S. EVE, F.R.S.C.

(Read May 26, 1914).

At a meeting of the Royal Society of Canada held at Montreal, May, 1914, the writer gave by request a summary of recent work and ideas on the nature of the atom. The object was to concentrate, as clearly as possible, but not exhaustively, the results and opinions scattered through many different publications. Few men have time or opportunity to collect and analyze for themselves the large output bearing on this fascinating subject.

(1). It may be well to call attention to the general bearing of the situation. Biologists are divided into three camps—vitalists, mechanists, and those who sit on the boundary fence. The mechanists believe that all phenomena relating to life are attributed to the action of physical and chemical processes only. The vitalists believe that life involves something beyond and behind these. Now those who investigate natural philosophy, or physics, are endeavouring with some fair initial success, to explain all physical and chemical processes in terms of positive electrons, negative electrons, and of the effects produced by these in the ether, or space devoid of matter.

If both the mechanists are right, and also the physicists, then such phenomena as heredity and memory and intelligence, and our ideas of morality and religion are explainable in terms of positive and negative electrons and ether. All of these speculations are really outside the domain of Science, at least at present.

(2). It has been remarked by Poincaré that each fresh discovery in Physics adds a new load on the atom. The conditions which the atoms have to explain may indeed be written down, but to do so is merely to make a complete index for all books on Physics and Chemistry in the widest sense.

(3). In the early days of the Kinetic Theory of Gases, now well established in its broad outlines, it was sufficient to regard the atom as a perfectly elastic sphere, and it is not a generation ago that leading savants were triumphantly determining the effective radius as about 10^{-8} cm. (a convenient shorthand for the hundred millionth of a centimetre).

The discovery of electrons, as the cathode rays of an electric discharge in an exhausted tube, and as the beta rays of radium,

opened up new regions.* It appears that negative electricity consists of electrons with their accompanying but unexplained effects in the ether. Electrons in motion produce magnetic fields. Their effective mass is about one eighteen hundredth part of that of a hydrogen atom, and their effective radius one hundred thousandth. The greatest known speed of electrons nearly approaches that of light.

The Zeeman effect, or separation of a single line in the spectrum by suitable magnetic fields into two or more lines, proved conclusively that the vibrations of negative electrons in the atom are the cause of the disturbances in the ether which we know as light.

(4). The first scheme of an electronic atom, propounded by Sir Joseph Thomson, was a sphere of positive electricity, of undefined character, within which revolved concentric rings of electrons in the same plane. There necessarily followed the simplicity of circular motion under a force to the centre proportional to the distance between the electron and the centre of the atom.

(5). Previous to this Lord Rayleigh had called attention to a serious anomaly. In a train of waves of a periodic character, the electric intensity E varies as the sine of nt, where t is the time and $2\pi/n$ is the period. As the equations involve the second differential of E, it appears inevitable that the square of n should appear in spectral series. As a matter of fact there appears not the square of n, but n itself. It is desirable to be more explicit. If parallel light from a luminous source passes through a slit and a prism, together with suitable lenses, then the eye or photographic plate can detect a number of bright lines forming the spectral images of the slit for different colours, provided that the source of light is luminous mercury vapour or hydrogen, or some such luminous gas. Many of these lines have been found to belong to one or more series crowding together towards the violet end. Balmer and Rydberg have found that the general type of formula for this frequency n is,

$$n = N_0\left(\frac{1}{a^2} - \frac{1}{b^2}\right)$$

where N_0 is a universal constant called Rydberg's number, the same in value for *all* electrons of *all* atoms; and a and b are whole numbers or integers. We shall refer later to the importance of Rydberg's constant and of this magnificent generalization.

The trouble to which Rayleigh referred was first faced by Ritz in a startling manner. He imagined that there were inside the atom,

*It is remarkable how little the general public has shared in this advance. In Montreal there were eleven thousand people witnessing a wrestling match while few availed themselves of an invitation to meetings and discussions of the Royal Society.

placed end to end, a number of small magnets with an electron constrained to move in a circular path around the line of magnets. With this hypothesis he was able to account correctly for the above law for series of lines in the spectrum.

We may appreciate Poincaré's criticism—"On a quelque peine à accepter cette conception, qui a je ne sais quoi d'artificiel."

Inasmuch as physicists endeavour to explain magnetism in terms of revolving electrons, there is a lack of simplicity, and there is an inconsistency, in introducing elemental magnets inside the atom. Nevertheless, it must be admitted that Weiss has found remarkable evidence for the conception of *magnetons*, or elemental unit magnets, producing intra-molecular fields reaching to millions of Gauss units, far transcending any produced by our most powerful electro-magnets, and difficult to explain by revolving electrons.

Again to quote Poincaré—

> "Qu'est-ce maintenant qu'un magnéton Est-ce quelque chose de simple? Non, si l'on ne veut pas renoncer à l'hypothèse des courants particulaires d'Ampère; un magnéton est alors un tourbillon d'électrons, et voila notre atome qui complique de plus en plus."

Perhaps the hypothesis of Bohr, explained later, may overcome the difficulty, but for some time to come, the more prudent will suspend judgment on the magneton.

Recently there has been nothing short of a revolution in Physics. In certain domains, the leading workers and thinkers have deliberately abandoned the classical dynamics and electro-dynamics, and made suppositions which are in direct opposition to these. This startling change may perhaps be justified by the fact that the famous laws and equations were based on large scale experiments, so that they do not necessarily apply to conditions within the atom. Those who put forward and make use of the new hypotheses, men like Planck and Lorentz, Poincaré and Jeans and others appear to do so with reluctance, like a retiring army forced from one position to another. Others like Rayleigh and Larmor appear to regard the whole movement with misgivings, and some endeavour like Walker and Callendar to find a way out. There is a young school who go joyfully forward, selecting and suggesting somewhat wild hypotheses, and yet attaining an unexpected measure of success by their apparently reckless methods.

The main phenomena to which the new mechanics have been applied are the radiation within an enclosure, and the distribution of energy therein; the high speed of electrons ejected from matter by ultraviolet light, or by Röntgen rays, or by the gamma or pene-

trating rays from radioactive substances, or as I suggest that we call them, from *radiants*; the atomic heat of elements, so admirably handled by Debye; the residual energy at low temperatures; and the constitution of the atom.

Space prevents us from considering more than the last of these.

The first step towards the new method was taken by Planck when he saw the necessity of explaining why the energy of short wave radiation is some hundred millionth part of that demanded by classical dynamics. He made the supposition that energy is not indefinitely divisible; but he did not assume that it was atomic. He actually imagined that energy was emitted from oscillators in exact multiples of hn, where n is the frequency of the oscillation and h is a universal constant (Planck's) with a value $6{\cdot}5 \times 10^{-27}$ erg second. The magnitude of the energy quantum is thus proportional to the frequency.

This quantum hypothesis has spread like fire during a drought. It pervades the scientific journals. No physicist has pretended to explain or understand it, for as Jean says, the lucky guess has not yet been made. Nevertheless it appears that "h" has truth underlying it, and that it has come to stay, for the applications of the quantum hypothesis have already achieved a great and unexpected measure of success. In the meantime it is necessary to proceed with caution checking every theory by experiment, for there is no other criterion to guide the investigator, whether to hold to the old, or try the new.

(7). The first steps towards the idea of the modern or Rutherfordian atom rest on an experimental basis, and are not therefore open to suspicion.

Rutherford and Geiger found that when the alpha particles from a radiant, such as radium or polonium met a thin gold leaf, the bulk of the alpha particles passed through with slight deflection, but about one in eight thousand bounced back, or returned towards the side of their source. Both large and small deviations of the alpha particles in passing through matter were satisfactorily explained by ordinary or Newtonian dynamics, with the law of repulsion inversely as the square of the distance between similar electric charges. One charged particle was the alpha particle with a positive charge twice as large, numerically, as that of an electron. The other charged particle was the *nucleus* of the atom of gold, and the magnitude of this charge was about $\frac{1}{2}$A where A is the atomic weight of gold. This view was subjected to a searching series of experimental tests and emerged triumphant.

(8). About this time C. T. R. Wilson skilfully obtained photographs of the mist-ladened, charged air molecules, marking the track

of a recent alpha particle in an expansion chamber. Some of these photographs showed where a collision had occurred between an alpha particle and one of the heavier molecules of air. It immediately occurred to Sir Ernest Rutherford that a collision between an alpha particle and a lighter atom, such as hydrogen, would result in the nucleus of the latter being projected beyond the known range of the alpha particle. The point was put to the test by Marsden, and a complete justification of Rutherford's nucleus resulted. The hydrogen nuclei were found to produce scintillations on a zinc sulphide screen at a range about *four times as great* as that of the alpha particles. Some mathematical investigations by G. C. Darwin indicated that the alpha particle or nucleus of helium, and the hydrogen nucleus must have approached so close that their centres were but $1 \cdot 7 \times 10^{-13}$ cm. apart. This affords further evidence of the extreme minuteness of the nucleus compared with the size of an atom (10^{-8} cm.)

(9). It may be well to recall at this point an interesting result of Barkla, obtained some years earlier, who showed from the scattering of Röntgen rays that the number of electrons in the atom must be about $\frac{1}{2}$A, where A is the atomic weight. In the case of an uncharged atom, the positive charge on the nucleus must evidently balance the negative charges on the electrons revolving in orbits around that nucleus.

Thus we can form a clear mental picture of the general character of the atom. It is a miniature solar system. The sun is represented by the positively charged nucleus, the planets, perhaps confined to one or more definite orbits or rings, by negative electrons revolving rapidly around the nucleus. The gravitational force is replaced by the electrical attraction between the positive nucleus and negative electrons.

(10). A brilliant young Dane, Bohr, has gone a step farther and suggested the structure of an atom capable of explaining the series of spectral lines. His work is remarkable as leading to excellent numerical verification. He assumes the Rutherfordian nucleus of electronic charge about half the atomic weight; he also assumes that for every revolving electron in every atom the angular momentum is constant. To be concise he supposes that for each electron, mass $\times$ velocity $\times$ radius = Planck's constant $/2\pi$.

He further supposes that in a steady stationary orbit even a single electron does not radiate away energy. *This is entirely contrary to classical electrodynamics.* Furthermore he imagines that in passing from one state of stationary orbit to the next possible, there is homogeneous radiation of amount hn, where n is the frequency.

This is of course Planck's assumption, and it is certainly unexplained and probably not in accord with Hamilton's equations as deduced from Newton's Laws. Nevertheless any day we may learn why energy is emitted *per saltum*, and this mystery will vanish.

Now if you permit these somewhat arbitrary assumptions to Bohr, he can and does deduce, at least for the lighter atoms such as hydrogen and helium, the Rydberg formula for the spectral series. He finds—

$$n = \frac{2\pi^2 me^4}{h^3}\left(\frac{1}{a^2} - \frac{1}{b^2}\right)$$

where n is the frequency; m,e mass and charge of an electron, h is Planck's constant: a,b, are integers. The quantity before the bracket should equal the Rydberg number N_0 of observed value $3 \cdot 29 \times 10^{15}$. Bohr's calculated value is $3 \cdot 26 \times 10^{15}$, showing a most satisfactory agreement.

Bohr endeavours to account for the manner in which two hydrogen atoms form a molecule. Each atom has a nucleus of positive charge and a simple electron revolving around it. Their charges are equal and opposite. The nuclei of two such atoms repel each other. The revolving electrons of two atoms close together, if rotating in the same direction, constitutes two parallel currents of electricity, and these attract one another and arrive in the same plane. It is easy to make a model on a whirling table with the nuclei on an upright rod, the electrons revolving like the governor balls of an engine. Bohr has gone further, and conceived a similar model of a water molecule with the two nuclei of hydrogen and one nucleus of oxygen in a straight line, with 10 electrons revolving in their zones around them. No doubt these suggestive schemes are somewhat speculative, but it is refreshing to find a first approximation to a dynamical scheme replacing the old unsatisfactory electrostatic atoms, which probably did not approximate to the truth. Some of the formidable organic molecules must have a complexity which it may take generations of physicists to unravel.

(11). One of the triumphs of mathematical physics was the forecast of Laue that crystal bodies have their atoms so distributed that Röntgen rays must be diffracted by these atoms in the same manner that closely ruled crossed lines on a glass plate diffract visible light. This forecast and its rapid verification, enabled the two Braggs, father and son, to measure with accuracy the wave lengths of Röntgen rays. While the waves of invisible light are of the order 10^{-5} cm., those of Röntgen rays are of the order 10^{-8} cm. or about one thousandth of the former. The electromagnetic theory recognizes

no intrinsic difference between the great waves of wireless telegraphy, several kilometres in length (10^6 cm), short electric waves, long heat waves, visible light (10^{-5} cm), ultraviolet waves, Röntgen rays, (10^{-8} cm), and gamma rays (10^{-9}).

The method of reflecting Röntgen rays from a rocksalt or other crystal has been applied by Moseley with marked success to the determination of the nucleus charges of the atoms of most of the elements. He bombarded the elements one after the other, by electrons as cathode rays and reflected the resulting Röntgen rays from a crystal, and measured the wave lengths of one or other of the principal (K or L, hard or soft) radiations.

In this manner he found—

$$n = A(N—B)^2.$$

where n is the frequency of vibration, N the nucleus electronic charge, necessarily a whole number, and A and B are determined constants. In this manner he has found the *atomic numbers* N of all the known elements from aluminium 13 to gold 79. There appear to be but two or three elements not yet found by the chemists. These experimental results bear out well a view first propounded by van den Broek, that each element has an atomic number, an integer representing its place in the periodic table (H 1, He 2, Li 3, Be 4, Bo 5, C 6, and so forth.) The atomic weight is not an exact integer, nor of such fundamental character as the atomic number. There will be further reference to this point later.

(12). Rutherford has extended Moseley's method and results to the crystal reflection of the gamma rays from a radiant (RaB) and determined the wave lengths of many lines, in particular of the two strongest. He has bombarded lead with Ra B rays and found the wave lengths of the radiation stimulated in the lead. He found that *Radium B and lead gave the same spectrum*, indicating that they have the same atomic number, 82. Hence he deduced the atomic numbers of all the radiants in the uranium-radium family. His results are worth repeating.—

Radiant	*Rays*	*Atomic number*	*Atomic weight about*
Uranium 1	α	92	238·5
" X 1	β	90	234·5
" X 2	β	91	234·5
" 2	α	92	234·5
Ionium	α	90	230·5
Radium	α	88	226·5
" Em.	α	86	222·5

Radium A.	α	84	218·5
" B	β	82	214·5
" C	α,β	83	214·5
" D	β	82	210·5
" E	β	83	210·5
" F	α	84	210·5
Lead		82	206·5 (207·1)

(13). All of these results are in harmony with the wonderful advances in radio-chemistry due to Soddy, Fajans, Von Hevesy and others. It has been found that when a radiant emits an *alpha* particle or helium nucleus, the chemical properties of the newly formed radiant differ from the old. A fresh element is formed, a different valency results, and the new radiant, relative to the old, is two columns to the *left* in the periodic table. The atomic number has decreased 2, and the atomic weight about 4. But when a radiant ejects a *beta* particle or electron, again there is a new radiant with different valency and chemical properties, but there is a move of one column to the *right* in the periodic table, a gain of one in the atomic number and no change in the atomic weight.

A brief example of the whole scheme applicable to all radiants is given below.—

Column	IV.	V.	VI.	At. wts.
	Ur X 1→ β, 90	Ur X 2 → β, 91	Ur 2 α, 92	234.5
			Ur 1 α, 92	238.5

In the case of these radiants Ur **1** evicts an α particle and gives rise to Ur X 1. The latter and Ur X 2 respectively emit a β particle.

It should be added that the short lived product Ur X 2, or "brevium," was discovered by this theory after it had been formulated from the known behaviour of other radiants.

It will be seen that Uranium 1 and 2 are in the same column and have the same atomic *number*, but that their atomic *weights* differ by 4. Such substances have chemical properties so identical that they are called "*inseparables*," or "*non-separables*," or "*isotopes*,'

for they occupy the *same* place in the periodic table. Thus the old trouble of finding room in the periodic table for the thirty or forty radiant elements has suddenly vanished. They may be superposed even when their atomic weights differ, if their atomic numbers are the same. The nuclear charges of isotopes must be identical but the distribution of electrons may be different. Other examples of inseparables are—

Lead, radium B, Radium D, all 82.
Thorium and radiothorium.
Radium and mesothorium.

If these views are distasteful to chemists let them discover some method of separation of the known isotopes.

It must be further noted that the results of radio-chemistry appear to require the presence of negative electrons in the nucleus itself. The expulsion of a β particle, or one negative electron, from the nucleus is equivalent to the gain of one positive electron, and involves a unit increase in the atomic number.

(14). The last advance is the most important and far-reaching. There has been long search for the positive electron and in vain, yet it seems likely that it has been under our eyes all the time. Since the hydrogen atom never loses more than a single electron, is it not possible, suggests Rutherford, that the nucleus of the hydrogen atom may be the positive electron?

The electro-magnetic mass of an electron is $\frac{2}{3}\frac{e^2}{a}$ where e is the charge and a the radius. If the mass of the hydrogen nucleus is wholly electro-magnetic, then its radius must be smaller than that of the electron (negative) as 1: 1800, for that is the ratio of their masses while their charges are equal and opposite. Hence we have—

	Mass.	Diameter.
Atom	1	10^{-8} cm.
Negative electron	1/1800	10^{-13}
Positive electron	1	10^{-16}

Rutherford cautiously remarks that there is no experimental evidence against such a supposition.

Those who wish to follow the matter deeper must refer to many articles in the Philosophical Magazine, several letters to Nature, Soddy's "Chemistry of the Radio-elements, part II," and Perrin's "Les Atomes." The chief writers have been Rutherford, W. H. Bragg, W. L. Bragg, G. C. Darwin, Moseley, Brock, Bohr, Fajans, Soddy, Russell, Hevesy, Nicholson and Marsden.

Much has yet to be done, and much to be revised, but that the first great forward strides have been taken in the right direction there can be little doubt.

A. S. Eve.

McGill University,
May, 1914.

The Crushing Strength of Ice.

By H. T. BARNES, D.Sc., F.R.S.

(Read May 27, 1914).

The crushing strength of ice is variously quoted as being from 327 to 1,000 pounds per square inch, as determined by a standard U. S. testing machine. The importance of this value in estimating the expansive force of an ice sheet makes it desirable to have more accurate knowledge of this constant. Czowski in 1871 determined it for ice below the freezing point, and found it 208 pounds per square inch. Ludlow made an estimate of it from a study of the ice of Delaware Bay. He concluded that it varied from 100 to 1,000 pounds with an average of 575 pounds.

C. A. Mees in a paper (not published) sent privately to me, concluded that the crushing strength of ice might reach as high as 800 pounds in a short column. He says, however, "Wherever the effects of ice expansion have been carefully observed, it has been noted that bending takes place, and this may be expected because we have a long column effect. On this account assuming one half the crushing strength may be developed before bending, the maximum thrust may equal about 400 pounds per square inch."

Probably the best experiments on the crushing strength of ice have been made by Mr. Geo. G. Bell. He worked with small cubes of approximately two inches. His results are summarized in the following table. See table I (Maine Society of Civil Engineers, Vol. I, 41, 1911).

If we neglect his highest result, which appears to me to be too high, we find values more consistent, ranging from 358 to 783 pounds. The second part of the table deals with the adhesion of ice to concrete blocks. The crushing force is given here somewhat less than from the direct experiments. Mr. Bell states that he considers 400 pounds a fair estimate of the crushing strength of ice from all his tests.

Present Experiments.

In order to determine the crushing strength with perfectly clear ice on somewhat larger blocks, I carried out a number of measurements using a hydraulic press. The blocks were cut from river ice which was specially selected for me through the kindness of the City Ice Co., Montreal.

One large piece 6″ × 28″ × 40″, furnished the largest number of individual blocks. The direction of the crystalline axis was determined by knowing the plane of freezing, and the various blocks were cut by a hand-saw accordingly. The ends of the blocks were melted smooth on a hot plate to fit the plates of the press. When the pressure was applied, considerable melting resulted on the ends. The blocks were kept outside at a temperature ranging from –8°C. to 0°C. and were brought into the laboratory for the tests. One interesting fact was noted, that the blocks were heard to crack at a pressure, approximately one half the ultimate crushing force. It was repeatedly observed that as soon as the pressure was increased sufficiently to cause the first audible crack, the block appeared to stiffen, and the pressure ran up much quicker, with much less melting. In some cases the melting appeared to cease altogether. I concluded that the giving way of the ice under pressure allowed the melted ice to run into the cracks, where it must have frozen and cemented the block more firmly. I was unable to see any of the cracks which we could distinctly hear at half the crushing pressure.

The only effect of varying the position of the axis of the ice with respect to the direction of the pressure, appeared to be the way the block burst. When the axis was parallel to the applied pressure, the ice burst sideways into innumerable long needles, resembling a cake of ice which has all but fallen to pieces in the sun. The cake fell to pieces on being removed from the press. When the axis was at right angles to the applied force, the block cracked lengthwise and transversely without shattering.

Fig. 1 shows a cake crushed in the direction of the axis, while Fig. 2 shows the reverse effect.

In Table II I give the results of the tests.

It will be seen that the mean value for all the tests for parallel axis is a little higher than the mean for perpendicular axis, but the difference is too small to make it possible to draw any definite conclusions.

The results show considerable variation, which may be purely accidental or may have some bearing on the character of the initial distribution of the pressure.

The relation between the first cracking of the ice and the final crushing force is one which must be further investigated.

The question of the relation of temperature to the crushing strength is one of importance. It has been assumed that ice becomes stronger at low temperature. The hardness of ice increases considerably as the temperature falls to 0°F. but I am inclined to think that the ice also becomes more brittle. In the neighbourhood of the freez-

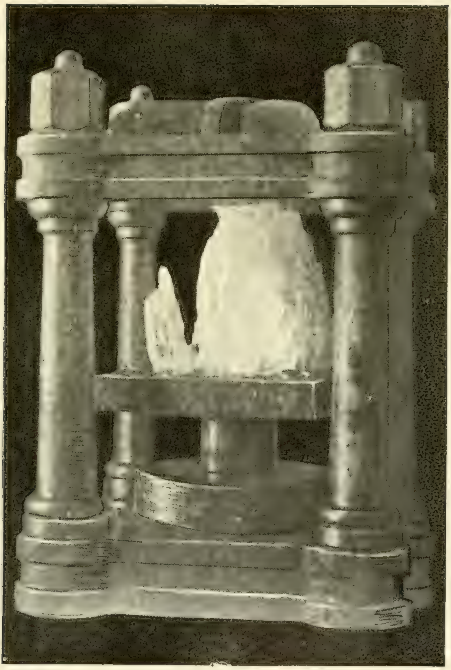

Figure 1

Showing an ice block crushed when the axis is parallel to the direction of the pressure.

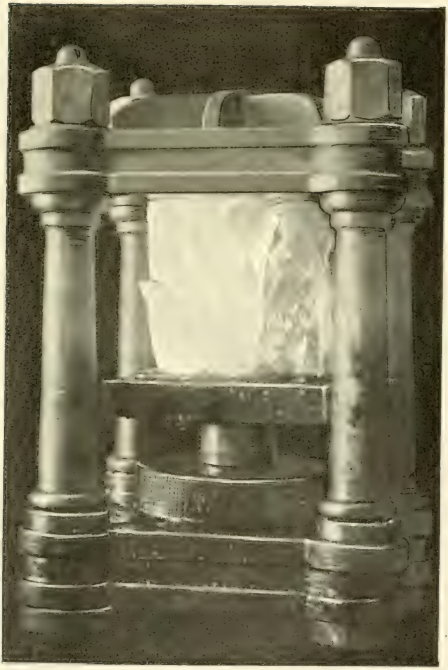

Figure 2

Showing an ice block crushed when the axis is perpendicular to the direction of the pressure.

ing point, ice is much more plastic than it is at lower temperatures. The plastic effect is, however, masked by the regelation effect, and it is a question whether the ice mass is not really firmer near the freezing point than when cooled much below. This can, however, only be settled by further experiment.

TABLE I.

RESULTS OF COMPRESSION TESTS (BELL).

No. of test	Size of cube	Crushing strength	Lbs. per sq. inch	Temp.'s Ice	Temp.'s Air	Remarks
1	2×2	1926 lbs.	481.5	18	27	$1\frac{23}{32}$ height after crushing.
2	2×2	2059 "	516	18	27	$1\frac{23}{32}$ " "
3	$1\frac{3}{4}\times1\frac{3}{4}$	3430 "	1128	13	25	
4	$1\frac{15}{16}\times2$	2074 "	535	32	40	Grain perpendicular to line of force.
5	$1\frac{3}{4}\times2$	2224 "	636	32	38	Grain parallel to line of force.
6	$1\frac{3}{4}\times2$	1884 "	538	32	39	Grain parallel to line of force.
7	$2\frac{1}{8}\times2\frac{1}{8}$	3400 "	753	32	40	Grain parallel to line of force.
8	$2\frac{1}{4}\times2\frac{1}{4}$	2474 "	488	32	40	These were 4 inches long and had grain par-
9	$2\frac{1}{4}\times2\frac{1}{4}$	1811 "	358	32	40	allel to line of force.
10	$1\frac{7}{8}\times2\frac{7}{8}$	3214 "	783	32	40	Perpendicular to line of force.
11	$2\frac{1}{8}\times2\frac{1}{8}$	3449 "	765	32	40	Parallel to line of force.

RESULTS OF ADHESION TESTS (BELL).

No. of Test	Size ice	Bevel Hor.	Bevel Vert.	Load at failure	Unit compression at failure	Unit adhesion to concrete	Method of fail	Temp. Fah.
1	$2\frac{1}{8}\times3\frac{1}{8}$	12	8	4200	370 lbs.	195	crushing	30°
2	$2\frac{3}{4}\times2\frac{3}{4}$	12	8	3800	504 "	228	"	30
3	$3\frac{1}{8}\times3\frac{1}{2}$	8	12	3856	395 "	158	crushed and sheared	32
4	$3\frac{3}{8}\times3\frac{1}{2}$	8	12	2960	250 "	116	adhesion	32
5	$3\frac{1}{8}\times3\frac{1}{8}$	1	1	4100	420 "	185[5]	compression	30

TABLE II.

Date.	No.	Size of block.	Direction of axis with respect to direction of applied pressure	Pressure when first crack was heard	Pressure when block crushed
Mar. 21	3	$3\frac{1}{2}\times6\frac{1}{2}\times4\frac{3}{4}$	Parallel	87 lbs.	289 lbs.
"	4	$6\frac{1}{2}\times5\ \times4\frac{1}{4}$	Perpendicular	123 "	247 "
"	5	$4\frac{1}{2}\times4\frac{1}{4}\times5\frac{3}{4}$	"	183 "	251 "
"	6	$5\frac{1}{4}\times4\ \times6$	Parallel	166 "	335 "
Mar. 26	7	$7\frac{1}{4}\times6\ \times6$	Perpendicular	183 "	424 "
" 26	8	$7\frac{1}{4}\times6\ \times6$	"	183 "	364 "
" 26	9	$6\frac{1}{2}\times6\ \times6$	Parallel	....	485 "
" 26	10	$7\frac{1}{2}\times7\ \times5\frac{1}{4}$	Perpendicular	....	238 "
" 26	11	$7\ \times7\ \times6\frac{1}{4}$	"	200 "	400 "
" 26	12	$7\frac{1}{2}\times6\ \times6$	Parallel	121 "	304 "
" 26	13	$7\frac{1}{2}\times6\ \times5\frac{1}{2}$	"	159 "	398 "
" 26	14	$7\frac{1}{2}\times6\frac{1}{4}\times5\frac{3}{4}$	Perpendicular	140 "	292 "
" 26	15	$7\frac{3}{4}\times6\frac{1}{2}\times5\frac{3}{4}$	"	234 "	422 "
" 26	16	$7\ \times7\ \times5\frac{1}{2}$	"	227 "	568 "
" 26	17	$7\ \times6\frac{1}{2}\times6$	Parallel	....	224 "
" 26	18	$6\frac{1}{8}\times6\ \times5\frac{7}{8}$	"	248 "	557 "

Mean 370 lbs. per sq. inch, axis parallel.
" 356 " " " " axis perpendicular.

Mean of both 363 lbs. per sq. inch.

Some Experiments in the Doctrine of Probability.

By ALFRED BAKER, M.A., F.R.S.C.

(Read May 27, 1914)

In what is known as local probability opportunities for treating the problems experimentally sometimes occur, affording an amusing relaxation to the student. It is not difficult, on the assumption that all positions of certain movable bodies (or the occurrence of certain geometrical forms) are equally likely, to devise problems in probabilities respecting such, and to calculate the probability of particular positions or of particular geometrical forms. Not often, however, have such problems been treated experimentally, and the results of experiment compared with the deductions of theory. In what follows three problems in local probability are treated experimentally, and the results compared with what theory affords. The first of these three has several times been made the subject of experiment. In the solution of the problem the geometrical constant π occurs. If such result be equated to the numerical result as obtained by experiments, we seem to have a means of determining the numerical value of π. An account of the result obtained by certain experimenters will be found in Ball's "Mathematical Recreations and Problems."

Problem 1. An indefinite number of equidistant parallel lines are drawn on a plane, and a rod whose length is equal to the perpendicular distance between two consecutive lines is thrown at random on the plane. The probability of its falling on one of the lines is $\frac{2}{\pi}$

$$\text{Probability required} = \frac{2\int \operatorname{Cos}^{-1}\frac{a-x}{2a}\,dx + 2\int \operatorname{Cos}^{-1}\frac{a+x}{2a}\,dx}{2\pi a} = \frac{2}{\pi}$$

$= \frac{2}{3.14159..} = \cdot 6366\cdots$. The length of the rod is 2a.

i.e., in 10	throws	the rod	should	cross	a line		6·366	times.
100	"	"	"	"	"	"	63·66	"
1000	"	"	"	"	"	"	636·6	"

In the experiment a glass rod was employed to avoid the chance of magnetization which might incline the rod, when free in the air, to point north and south. A very fine rod was selected that it might approximate as nearly as possible to a straight line. The drawing board on which the lines were ruled was carefully levelled. In all

3,800 throws were made. Taking any 10 consecutive throws the widest possible divergences from the $6 \cdot 366$ of theory were observed, the incidences on the ruled lines varying from 3 to 10. Here are numbers selected from ten consecutive decades:—

3, 4, 8, 8, 8, 7, 10, 5, 4, 6.
Again 6, 7, 4, 7, 7, 9, 5, 4, 4, 6.

Taking 100 consecutive throws a much closer relative agreement between experiment and the $63 \cdot 66$ of theory was observed. In the first 1000 the incidences (for 100) on the ruled lines varied from 59 to 74; in the second 1000 from 59 to 71; in the third 1000 from 55 to 75.

Taking 1000 consecutive throws a wonderfully close agreement between experiment and the $636 \cdot 6$ of theory was observed. Thus in the first 1000 there were 633 incidences on the lines.

And finally taking the entire number of throws (3800) while theory gave 2419 incidences on the lines, experiment gave 2423—a marvellously close agreement. These 2423 incidences give $\frac{2423}{3800}$ as the probability that in a given throw the rod shall cross a line. Theory gave $\frac{2}{\pi}$. Equating these results we have $\pi = 3 \cdot 1366$—not so very remote from the well known number $3 \cdot 14159$.

Problem 2. Two points are taken at random in a triangle. The chance that the line joining them shall cut two particular sides is 1/3.

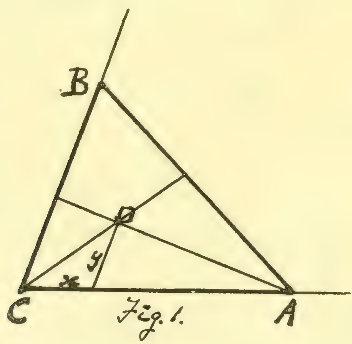

Fig. 1.

Probability required

$$= \frac{\int_0^b \int_0^{a\left(1-\frac{y}{b}\right)} \frac{1}{2} a \operatorname{Sin} C\, y \left\{ \frac{1}{\frac{x}{a}+\frac{y}{b}} + \frac{1}{1-\frac{x}{a}} - 2 \right\} dx\, dy \operatorname{Sin} C}{\left\{ \frac{1}{2} a\, b \operatorname{Sin} C \right\}^2}$$

$$= \tfrac{1}{3} = \cdot 333 \cdots\cdots$$

i.e. in 10 locations of points line should cross sides 3·33·· times.
" 100 " " " " " " 33· 3·· "
" 1000 " " " " " " 333. ·· "

In the experiment a smooth triangular board was used with barriers at the edges. Fine shots were used for points, 5 being employed so as to give 10 combinations at each change in their positions, which was effected by means of a whisk. Minute glass globes might have been better than shot from their greater elasticity and therefore less tendency to locate themselves near the sides. The board was of course carefully levelled with a spirit level.

In all 1000 events were produced. Taking any 10 consecutive locations the widest possible divergences from the 3·33·· of theory were observed, the number of times the joining line crossed the given sides varying from 0 to 8. Here are numbers selected from 10 consecutive decades:—

3, 2, 7, 5, 4, 1, 5, 4, 0, 4.
Again 4, 3, 8, 4, 2, 5, 2, 2, 2, 4.

Taking 100 consecutive events, a much closer relative agreement was observed between experiment and the 33·3·· of theory in the 1000 the intersections varying from 26 to 37.

Taking 1000 consecutive throws, a wonderfully close agreement was observed between the 333·3·· of theory and experiment, there being by experiment 332 intersections.

Problem 3. Two points are taken at random on a given line of length a; the chance that the distance between them shall exceed a given length c is $\left(\frac{a-c}{a}\right)^2$

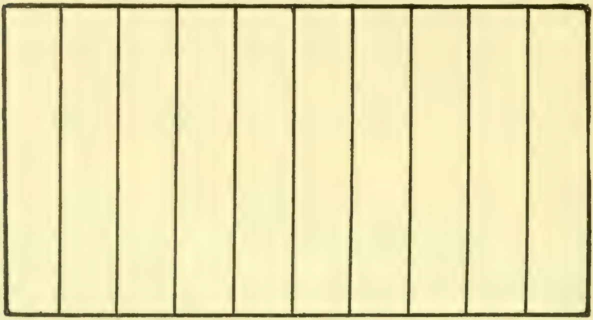

Fig. 3.

These spaces were divided into 10 equal parts by lines parallel to the above.

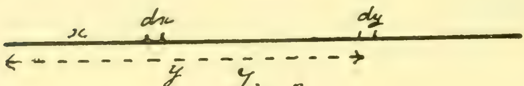

Fig. 2.

$$\text{Probability required} = \frac{\int_c^a \int_o^{y-c} dx\ dy}{\int_o^a \int_o^{y} dx\ dy} = \left(\frac{a-c}{a}\right)^2.$$

i.e., if $a=100$, we get, according as $c=25$, 50 or 75, probability $=$ $\frac{56\frac{1}{4}}{100}$, $\frac{25}{100}$ or $\frac{6\frac{1}{4}}{100}$.

(1). c=25.

In 10	locations of	points	dis.	bet.	them	shd.	exceed 25,	5·625	times
100	"	"	"	"	"	"		56·25	"
1000	"	"	"	"	"	"		562·5	"

(2). c=50.

In 10	locations of	points	dis.	bet.	them	shd.	exceed 50,	2·5	"
100	"	"	"	"	"	"		25	"
1000	"	"	"	"	"	"		250	"

(3). c=75.

In 10	locations of	points	dis.	bet.	them	shd.	exceed 75,	·625	"
100	"	"	"	"	"	"		6·25	"
1000	"	"	"	"	"	"		62·5	"

In the experiment it was not practicable to take points at random on a line. The object however, was attained by having a rectangular board constructed with barriers along the edges, and lines ruled on it parallel to one of the sides, "points on a line;" then meant the same as points on this board estimating distances only at right angles to the ruled lines. The ruled lines enabled one quickly to determine those distances. As before 5 shots were used giving after each disturbance 10 combinations. In all 1000 events were produced.

Taking any 10 consecutive events, the widest possible divergences from the 5.625 2·5 and ·625 of theory were observed, the number of times the distance between the points exceeded 25, 50 and 75 varying from 0 to 8, from 0 to 6 and from 0 to 6 respectively. Here are numbers selected from 10 consecutive decades:—

c=25. . . . 6, 7, 6, 6, 6, 8, 6, 8, 3, 0.
c=50. . . . 5, 0, 1, 6, 0, 2, 6, 0, 1, 1.
c=75. . . 0, 0, 0, 0, 3, 2, 0, 0, 1, 2.

Taking 100 consecutive events a much closer agreement between experiment and the 56·25, 25, and 6·25 of theory was observed, in the 1000 the number of times the distances exceeded 25, 50 and 75 varying from 55 to 63, from 16 to 33, and from 2 to 10 respectively.

Taking 1000 consecutive events a remarkably close agreement between experiment and the 562·5, 250 and 62·5 of theory was observed there being by experiment 577, 253 and 66 occasions on which the distance between the points exceeded 25, 50 and 75 respectively.

Now some one may ask what does all this prove? That the theoretical solutions of the problems were correct? Not at all. Here the mathematician in all confidence and truth can say: If the facts do not agree with the theory so much the worse for the facts. Any one with sufficient knowledge of mathematics would be absolutely

sure that the theoretical solutions were correct (without any experiment at all) assuming that the hypothesis on which the solutions were based was correct. And what was this hypothesis? Evidently that the rod and the shots located themselves by chance, i.e., that all positions were equally likely, and that in a great number of throws or disturbances they would be equably distributed in the different possible positions. The agreement then shews that this hypothesis was realized, was attained in the experiments. The rod and the globules did not locate themselves *by chance*; their every movement was guided and controlled by fixed and definite laws—the various forces in my arm, gravity, the resistance of the air, the elasticity of the bodies, the slight inequalities of the surfaces, friction, &c.; but no one cause operated to constrain the objects into constancy of position, and the result was a marvellous evenness of distribution where a large number of events occurred. We might be inclined to expect that, where a number of causes operate, conflicting with and in part neutralizing one another, there might be, where a large number of events occurred, an utter unevenness of distribution, the events accumulating in heaps at one place and leaving another quite blank. Such, however, did not occur in the case of the experiments I have given an account of; and with respect to them we may assert that where a number of causes operate what we may term the "Law of Equable Distribution" prevails.

The Expansive Force of Ice.

By H. T. BARNES, J. W. HAYWARD and NORMAN M. McLEOD.

(Read May 27, 1914.)

The expansive force of ice is a matter of very great importance in engineering work. In the design of concrete dams the amount of allowance for the thrust of the ice sheet, is as yet a somewhat uncertain factor. Engineers are divided as to the amount to be allowed.

C. A. Mees gives some of the values which are assumed by various authorities in the design of dams. He gives the following:

G. P. Stearns (Wachusett Dam)—47,000 lbs. per linear foot.
Board of Experts (Quaker Bridge Dam)—43,000 lbs. per linear foot.
J. D. Van Buren (Tran. Am. So. C.E.)—40,000 lbs. per linear foot.
S. M. Gray (Columbus, Ohio)—34,000 lbs. per linear foot.

He works out, from data on the modulus of elasticity of ice by taking the crushing strength of ice as 400 lbs. per square inch, values similar to these. He admits that according to his references, the case of a failure of a dam, which he studied, was caused not by pure temperature expansion, but more probably by a change in water level.

A more recent paper by Mr. Walter H. Sawyer (Proceedings Maine Society of Civil Engineers, Vol. I, p. 27, 1911)—gives a very clear and satisfactory account of his direct observations of the ice thrust on several large lakes. He gives also some very valuable measurements of the expansion coefficient of ice at different temperatures. He cites authorities as follows:—

Wegmann (Croton Dam)	43,000 lbs.
Morrison and Brodie...............	47,000 "

In his own work on the construction of the Azicohos Dam on the Magalloway River he was obliged to select a value for the ice thrust, but owing as he says, "to the meagre information on this subject," it was difficult to arrive at any definite conclusion. Experiments were therefore undertaken by Mr. Sawyer to determine the thermal expansion and contraction of ice at different temperatures, the crushing strength of ice, and the tensile strength.

Mr. Sawyer's first observations were made of the expansion ridges or "wrinkles" on some of the Maine lakes which were observed

to form during the Winter season. He describes his observations as follows:—

"Early in the Winter of 1910 the Superintendent in charge of one of the Rangeley Dams was instructed to be on the watch for the formation of reefs, and about the first of January, 1911, information was received of the formation of reefs on Lake Mooselucmeguntic, and a party was immediately sent to study the formation and to gather information from residents in that section.

"Following are the conclusions reached after investigation, making observations, and sifting the evidence.

"The ice first cracked at the site of the reef during a cold period about December 22nd, 1910.

"On January 2nd there was a rise in temperature from 3° below zero to 41° above.

"A large reef was formed about 10.00 a.m. on January 2nd, 1911.

"When reefs form they do so near the same location each year.

"Reefs form in a warm period preceded by a very cold one, and may form at night if the temperature is rising.

"Reefs generally form when the ice is free from snow, or at least with very little upon it.

"Reefs do not always occur where there is a crack in the ice neither do they always rise, as occasionally one sheet may slide under another.

"Reefs act for a time as expansion joints,—that is the peak of the reef may rise and fall with expansion and contraction of the ice sheet.

"They seldom occur when the ice is over a foot thick, but instances are known where they have been formed with ice twenty inches thick.

"They are generally higher at the middle of the lake than at the shores.

"No pushing up of rocks or soil is noticed in bays or inlets."

Figs. 1 and 2 show how the ice is lifted during the formation of expansion reefs.

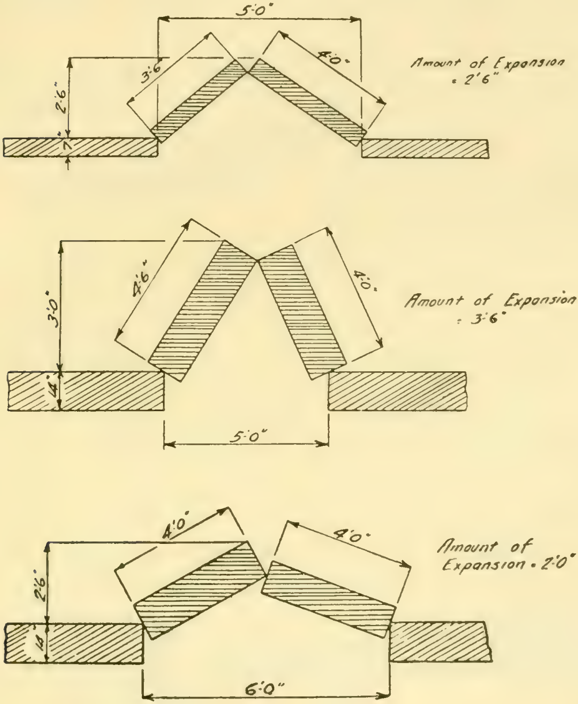

Fig. 1. Sketches showing forms taken by ice reefs in expansion cracks. (Sawyer).

After making his observations on reefs, Mr. Sawyer devoted himself to a careful study of the expansion of ice. In this he constructed a trough the total length of which was 100 ft. This was made

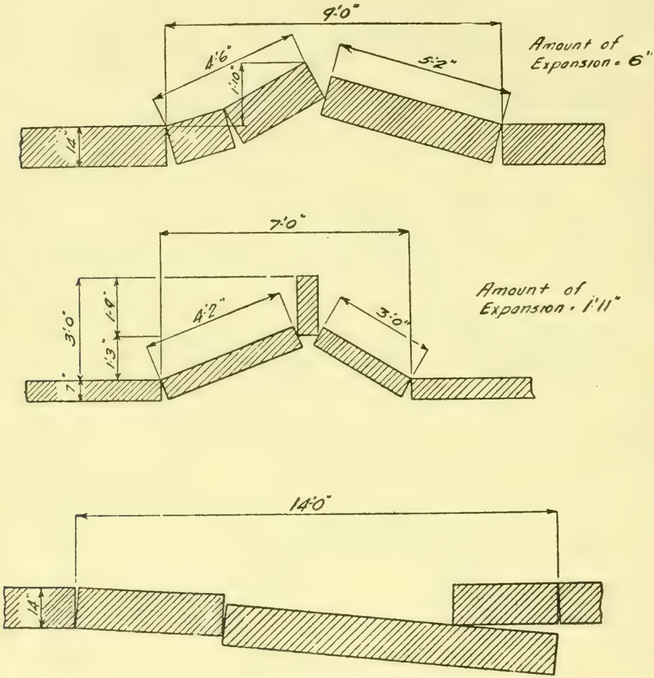

Fig. 2. Sketches showing forms taken by ice reefs in expansion cracks. (Sawyer).

in 5-ft. sections connected together with a bellow-like construction to allow for expansion and to maintain the whole apparatus watertight. The sections were constructed with a 2-inch by 8-inch plank bottom with 1-inch by 10-inch sides. Rollers were placed under the plank bottom, so that the sections would be free to move. The trough was filled with water, and after it was frozen the sides of the box were removed, so that the air would be in contact with as much of the ice as possible. An indicator was made by fastening one end of a swinging arm to one end of the ice box, the free end of the arm moving

in the arc of a circle which was divided into one-hundredths of a foot. The arm was 16 inches long and at a distance of 1 7/8 inches from the pivoted end was attached one end of a pine rod 1 inch square; the opposite end of the pine rod being attached to the opposite end of the ice column. As the column of ice varied in length, the pine rod remained at nearly a constant length. The temperature of the ice was found by reading a thermometer placed in the hole near the middle of the column. The true expansion of the ice between any two temperatures equaled the difference in scale reading at these two temperatures $\times 1\ 7/8 \div 16$, plus the linear coefficient of expansion of the pine rod $\times\ 100 \times 14\ 1/8 \div 16$. The coefficient of expansion of the ice equals the *total expansion* divided by the variation in temperature, multiplied by 100. In order to ascertain the coefficient of expansion of the ice per degree Fahrenheit, the total expansion between any two temperatures was divided by the total change in temperature assuming that the variation of expansion was uniform, which is not strictly true, as we find that the coefficient of expansion varies at different temperatures. The coefficient at the higher temperatures is much greater than at the lower temperatures. In computing the length of the pine rod, its temperature was taken as that of the air. The thermometers were only calibrated for even degrees, so that small variations in temperature gave but little information, six to eight degrees being the smallest change in temperature which did give consistent results.

During the first part of the experiments, Mr. Sawyer found that the ice would expand during the warm hours of the day, and contract during the cooler hours of the night, and that cracks were formed in the column which did not close during expansion due to rising temperature. To counteract this tendency to form cracks, weights were attached to the end of the ice column, and this device worked perfectly, the column remaining intact during the subsequent observations.

TABLE I.

COEFFICIENT OF EXPANSION OF ICE AS DETERMINED BY MR. SAWYER.

Date	Hour	Temperatures		Coeff. of Expansion of ice	Average Temp.
		Air	Ice		
Feb. 25	A.M. 11.30	+29°F	+14°F	0.0000285	+17.5°F
" 25	P.M. 4.30	+38	+21	0.0000317	+17.5
Feb. 26	A.M. 8.30	+25	+14	0.0000287	+3
" 28	A.M 10.30	+10	+2		
Feb. 28	P.M. 5.00	+14	+4		
Mar. 1	A.M. 10.00	+13	—3		
" 1	P.M. 4.30	+31	+12	0.0000211	+4.5
Mar. 2	A.M. 8.00	+18	+8	0.0000348	+10.0
" 2	P.M. 5.00	+35	+20	0.0000242	+14.0
Mar. 3	A.M. 8.00	+15	+14	0.0000202	+12.0
" 3	P.M. 5.00	+30	+13	0.0000226	+8.5
				0.0000291	
Mar. 4	A.M. 8.00	+15	—6		
				0.0000252	+9.0
" 4	P.M. 4.15	+23	+12		
" 5	A.M. 9.00	+9	—6		
				0.0000176	—2.5
Mar. 5	P.M. 5.00	+18	+1	0.0000211	—1.5
Mar. 6	A.M. 8.00	+11	—4		
" 6	P.M. 5.00	+19	+5		
				0.0000185	—2.5
Mar. 7	A.M. 8.00	+2	—10		—3
Mar. 7	P.M. 2.00	+28	+4	0.0000199	—1
Mar. 7	P.M. 5.00	+27	+8	0.0000211	+6
				0.00001705	—3
Mar. 8	A.M. 8.00	+1	—14		
				0.00001985	—4
" 8	P.M. 2.00	+39	+6	0.0000201	+0.5
				0.0000210	+10.5
" 8	P.M 5.45	+35	+15		
				0.0000242	+6.5
Mar. 9	A.M. 8.00	+12	—2		
				0.0000249	+5.0
" 9	P.M. 1.30	+42	+12	0.0000256	+8.0
" 9	P.M. 4.00	+42	+18		
" 9	P.M. 5.45			0.0000248	+8.75
Mar. 9	P.M. 5.45	+37	+19.5		
" 9	P.M. 8.00	+30	+16		
				0.0000302	+17.75
Mar. 13	P.M. 4.30	+39	+19.5		

"The results obtained were uniformly less than those obtained by Andrews[1], varying from eighty-five to ninety per cent of his results. There are two reasons which may account for this difference. 1. The ice in our experiment probably adhered to the plank forming the bottom, and free expansion was partly prevented. 2. The cross section of the column was large enough to prevent it assuming the temperature of the air in a short time, the observed lag in the temperature placed in the ice being very noticeable. Then too as the column was protected on the bottom by the plank, the temperature was not uniform throughout its mass, and the temperatures in the ice probably registered a greater variation than actually occurred in the ice as a whole.

"A study of the curves shows that the coefficient of expansion is a maximum at the freezing point, decreasing rapidly at first, the rate of decrease becoming less as the temperature approaches zero, while below zero the coefficient appears to decrease very slowly.

"Having demonstrated to our own satisfaction that ice expands or contracts as the temperature rises or falls let us consider the effect of variations of temperature of the ice covering the surface of a lake, assuming the ice to be free from snow.

If the temperature of the air is $t_1°$ F and that of the water $t_2°$ F. the temperature of the top surface of the ice will be nearly the same as the air when below the freezing point, while the bottom surface of the ice being in contact with the water will be at a little below the freezing point. As the ice in contact with the water remains at nearly the same temperature, and consequently expands and contracts but little, and as the ice in contact with the air is exposed to the greatest variations in temperature, and consequently the greatest amount of expansion and contraction, the actual expansion of the whole mass will be one-half of the maximum computed expansion of the range of temperature. The average coefficient of expansion of ice between –20°F. and 32° is ·0000284, so that the total expansion of a sheet of ice a mile long for a rise in temperature of 50 degrees Fahrenheit would be—

$$\frac{5{\cdot}280 \times \cdot 0000284 \times 50°}{2} = 3{\cdot}75 \text{ ft.}$$

"This corresponds closely with a statement by E. R. Beardsley in his pamphlet on the "Gravity Dam," that ice will expand nine-tenths of an inch per hundred feet for the maximum range in the tem-

[1] The best results we have of the expansion of ice at different temperatures were obtained by T. Andrews in 1885.

perature of the ice that we are likely to have in the Northern States. This is equivalent to an expansion of about 4 ft. per mile."

Mr. Sawyer's experience with this problem is so large that his conclusions should be of the greatest value and consequently we give them as follows:—

"The problem of the amount of force applied to dams by reason of ice expansion is not solved. There are many experiments and observations yet to be made, and in the end we cannot lay down a 'hard and fast rule' for the intensity of the ice pressure. As in all engineering problems the engineer will have to take into consideration the local conditions.

"For the purpose of aiding in the study of the problem, I give a few of the conditions which may be found at different places.

"A dam may be built at the upper end of a valley, the opposite shore of the lake or pond consisting of soft mud or silt, in which case it would be expected that the ice thrust would force up the mud into ridges, rather than act to over-turn the dam. If, however, the opposite shore is formed of ledge or of a very hard soil, precautions must be taken to meet the thrust on the dam.

"The width of the shore above the dam will have a great influence on the amount of thrust exerted. If the distance between the dam and the opposite shore is comparatively short, we may reasonably expect that the thrust will be a great deal more than it would be if the distance between the dam and the opposite shore is considerable. The ice, in the latter case, will act more like a long column; that is, it will have a greater tendency to buckle than in the first case, the movement of the ice, however, if such occurs, will be greater, the longer the sheet.

"If a dam is situated in a narrow valley, even a short distance below the reservoir, we would expect that the shore at the upper end of the valley would receive the greater part of the ice thrust, but if these shores would happen to be of a soft or yielding nature, some of the thrust might be passed on to the dam. If the dam is situated below a reservoir, the elevation of which is being constantly changed, as in a mill pond from which water is being drawn for manufacturing purposes, the ice will be broken at the dam and on the shores, and the liability of the occurrence of a dangerous thrust will be reduced. Slanting up-stream faces of dams do not add an element of safety against ice thrusts, unless the water level is constantly varying,—that is, the tendency to slip on the slanting surface is more than offset by the greater adhesion to the surface by reason of the large area of ice in contact. We will admit, however, that a vertical up-stream face will leave the dam open to receive blows from floating ice which would not be dangerous to the dam with a slanting up-stream face."

Observations made by the Authors upon the Ice in the Montreal Filtration Chambers, 1914.

In order to obtain some information on the expansion and contraction of a restricted field of ice, some observations were undertaken, of the behaviour of the ice sheet which had formed in the North East chamber or bay of the new Montreal Filtration Beds being constructed

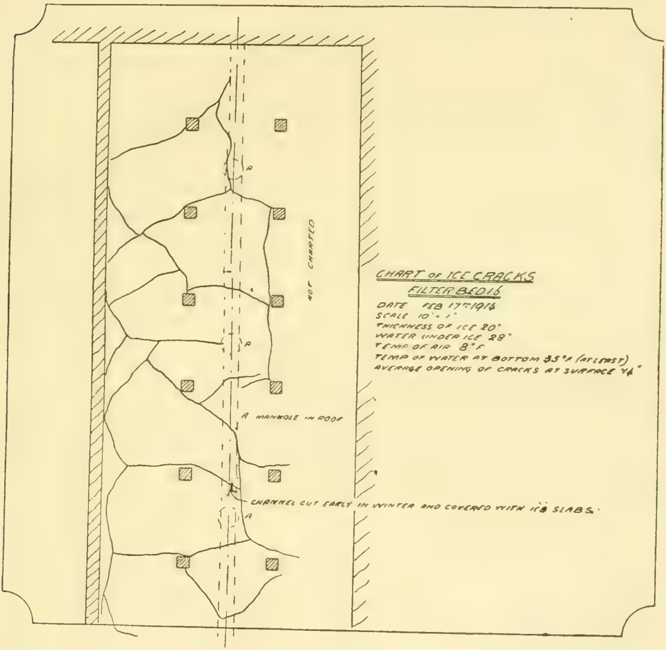

Figure 3.

by one of the authors (N. McLeod). This chamber is fifty feet wide and three hundred and fifty feet long. It is completely roofed with the exception of a few man-holes, the roof being carried on concrete pillars, thirty feet square, spaced nineteen feet apart. The North and East sides are banked up outside with earth. The West side is the division wall between this and the adjoining bay, and the South end is open and faces a wide passage crossing the whole plant. The

whole floor of the chambers had been flooded to a depth of about four feet. The ice which formed on the surface was quite clear enabling observations to be made of the condition of the under side of the ice. Direct observations were commenced on Feb. 17th of the system of cracks which had developed over the surface. In order to avoid any serious effect of ice expansion, a long channel had been cut through the ice. Over this channel a cover of ice blocks had been placed, which subsequently became cemented by freezing to the general surface.

In Fig. 3 we reproduce a sketch to show the position of the cracks with respect to the sides of the chamber and the pillars. When the temperature rose above the freezing point these cracks closed and disappeared, except where the upper edges had become chipped or rounded. A succeeding hard frost opened a new system of cracks similar to them. On Feb. 17th, and at the times when the temperature was well below the freezing point, the cracks started and opened as a rule from the pillars, and intersected, like the meshes of a net. Where blocks of ice had been removed from the channel and placed on the surface and became frozen to it, the cracks were observed to run directly through them without being deflected. This showed us that the tensile force of the ice which was exerted by the contraction of the general surface, acted in such a way as to split a thick block of ice, not contributing to the contraction.

All these cracks were observed to be wedge shaped, ending before the under surface of the ice was reached. This showed us that there was unequal contraction from the surface downwards. The breadth of the cracks seems to bear a close relation to the temperature.

TABLE II.

Size of Cracks in Relation to Air Temperature.

In examples measured there was only one crack in the 19 ft. between the pillars.

			Opening of crack.
Feb. 17th	Temperature	8°F.	·130 inch.
" 26th	"	21°F.	·079 "
Mar. 12th	"	22°F.	·063 "

We show in Fig. 4 a curve of the linear contraction of the ice from Andrews' measurements. The range of breadth of some of the cracks measured at various temperatures is indicated also. This shows us conclusively that the opening and closing of the cracks is affected by the temperature changes.

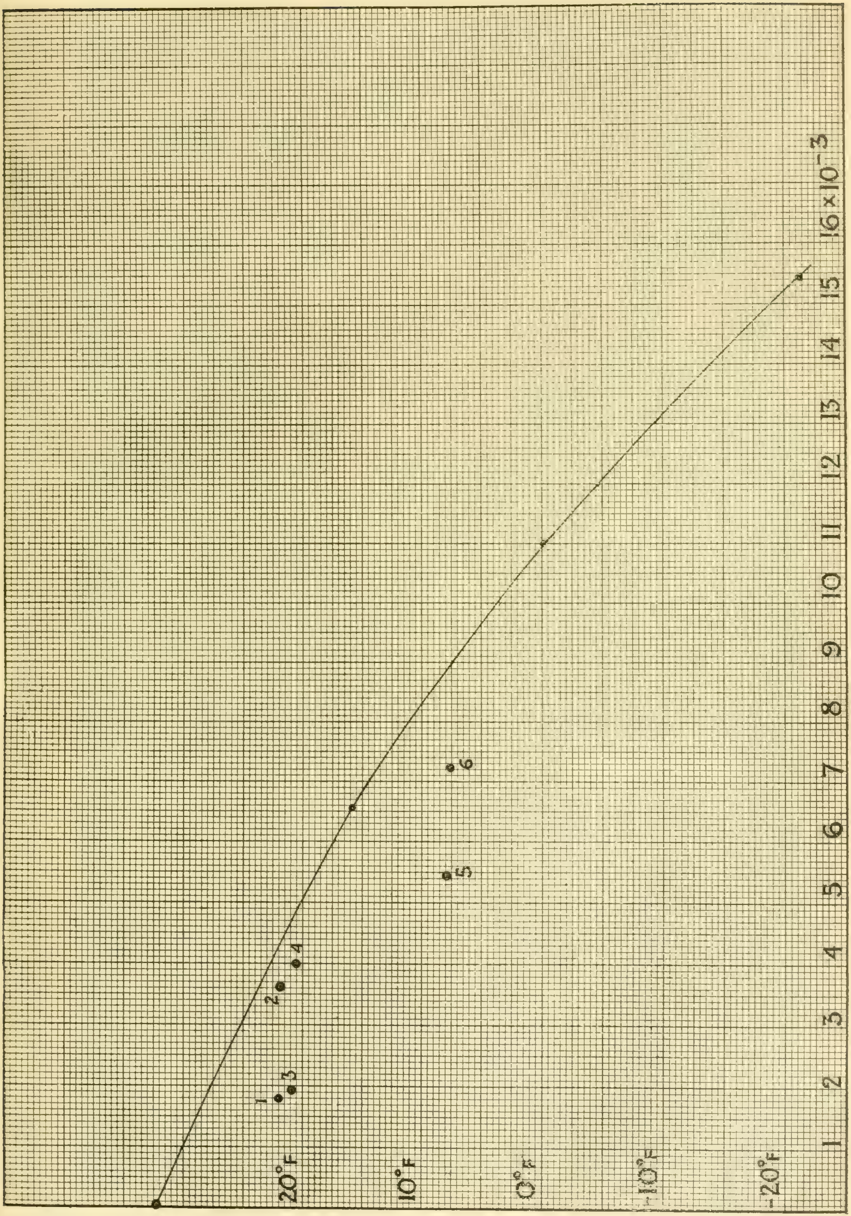

Figure 4.

Besides the cracks on the upper surface of the ice we observed distinct marks of cracks which had been produced on the underside and which extended roughly only half the thickness of the ice. We could see these cracks through the clear ice on account of the entrance of water into them, with subsequent freezing. From the restricted nature of the freezing, air bubbles were shown eliminated from the water in freezing. Each crack was marked by a thin vertical layer of whitish ice, which showed in contrast to the perfect clearness of the surface sheet.

Temperature of Water Under the Ice.

On Feb. 17th, an attempt was made to measure the temperature of the water under the ice. A special mercury thermometer was obtained, reading to hundredths of a degree, which was enclosed in a brass protective case with a valve in the bottom. An ice auger was used to drill the ice sheet. This made a clear hole about $1\frac{3}{4}$ inches in diameter, through which the brass case of the thermometer could be readily lowered. The act of lowering the thermometer caused the inrush of water through the valve of the case, and around the bulb of the thermometer. When held steady, or when raised the valve at once closed, thus trapping the water around the bulb. The thermometer could be then raised and the reading taken through a window in the case. The temperatures near the bottom ranged from 3·4°C. to 1·8°C. A more careful determination of the temperature from the ice surface to the bottom would have been interesting, and a special disc thermometer was constructed for this, but unfortunately the observations were never completed. It is doubtful if they would have yielded anything of importance for this investigation. We may say that the temperature at the underside of the ice was at 0°C. and increased rapidly to a probable maximum of 3·4°C. at the bottom. This is entirely as we should expect from a body of still water upon which ice has formed.

The disturbance of the water by cutting the hole and lowering the brass case was considerable and owing to this, the readings were variable.

Thickness of the Ice.

A series of measurements were made of the thickness of the ice sheet from Feb. 17th to March 14th. This period included some days of mild weather and rain previous to March 5th as well as some periods of intense cold. The mean results we show in Table III and plotted in Fig. 5.

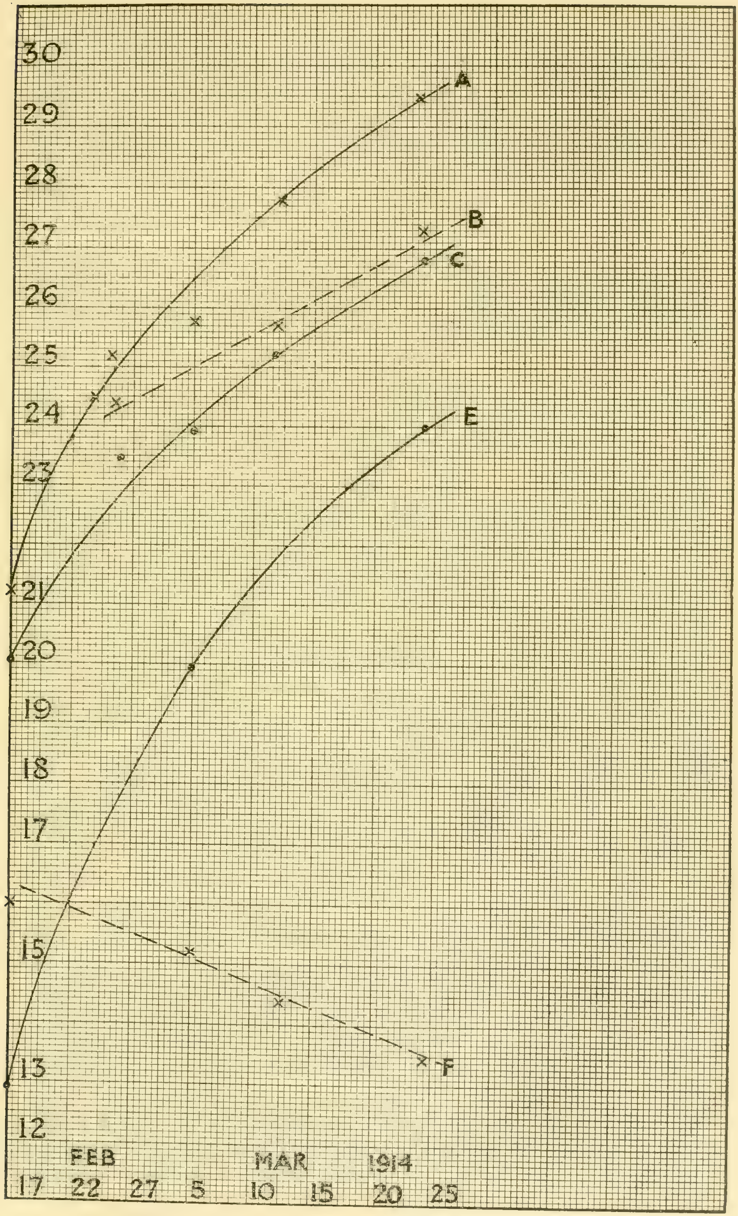

Fig. 5. Rate of Ice Growth.

They all show a gradual increase in thickness. The difference in the initial thickness is due to the position of the ice with respect to the openings through which the cold air gained admittance. This illustrates very well the protective action of a cover under which the heat of the water is more easily conserved.

Melting of the Ice.

The melting of the ice with the advent of warm weather was a problem of some difficulty. The roof prevented the rotting action of the sun which is the most powerful agent in nature for getting

TABLE III.

Table of Ice Thickness—Filter Bed No. 16.

February and March, 1914.

Date	Ice Thickness in Inches						Temp. of air chamber
	A	B	C	D	E	F	°F
Feb. 17	21¼	..	20	22	13	9	8
" 24	..	24½	..	..	..	..	..
" 26	25¼	24½	23½	..	..	..	21
Mar. 5	1½ ice ¼ water 24 ice	..	½ ice 1¼ water 22¼ ice	28¼	20	8¼	36
Mar. 12	27¾	25¾	25¼	27½	20	7½	22
" 24	29½	27¼	26¾	30½	24	6½	28

A. Thickness near south or open end of chamber.
B. " " centre of chamber.
C. " " north or closed end of chamber.
D. A channel in the ice was made down the centre of the chamber and covered with blocks of ice early in the winter. Measurements were taken near the north end through these blocks where it was found that ice had formed downwards on these blocks, into the channel giving a greater thickness as indicated.
D. = total thickness.
E. = Depth of ice extending below general surface.
F. = Height of block above general surface.

rid of ice. Some water was pumped out of the beds under the ice and soon after the ice thawed along the concrete walls and pillars, and settled down on the water again without breaking or getting jammed. A steam boiler was erected and live steam blown into the water under the ice. This proved very effective locally, but not enough circulation could be set up to melt a wide area.

Theory of Ice Cracks.

The forces set up in a large sheet of ice when the changes of temperature occur are very great. They are also unequally distributed

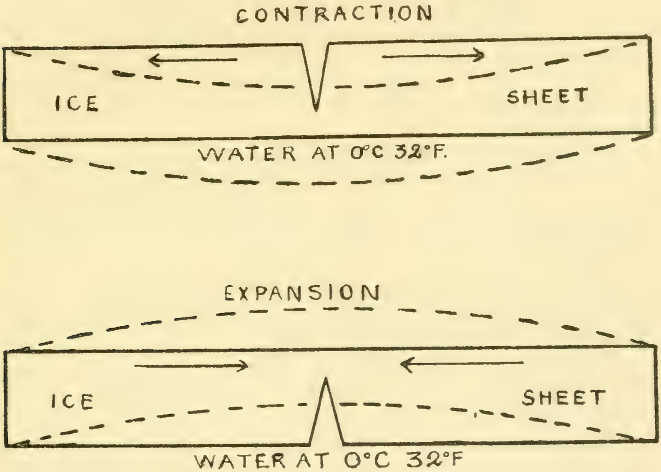

Figure 6.

throughout the ice thickness, and thereby cause the ice to bend readily. It has been concluded by many observers that a large ice sheet will buckle and bend before the ultimate crushing strength of the ice is reached. This we believe to be true, for the strains set up in the ice sheet all tend to assist this bending. Let us consider the contraction and expansion of an ice sheet represented in Fig. 6. In the upper block we suppose the upper surface subject to a cooling atmosphere below the freezing point. The under surface of the ice being in constant contact with the water cannot ever differ by more

than a very small fraction of a degree, from the freezing point. Hence we cannot have changes of length taking place at this surface by pure expansion or contraction. The temperature falls upwards through the ice to the surface, the gradient depending on the thickness of the ice and the period of the cold or warm wave affecting the upper surface. Contraction takes place in the upper surface, which causes the sheet to bend downwards as we have represented by the dotted contour. Under the tension the ice cracks, as represented in the diagram. No force of a harmful nature can be exerted at the edges of the ice sheet, under these circumstances. As long as these cracks remain open, they act as pressure cracks, to take up the thrust of the ice, when the temperature rises. In general we may assume, however, that these cracks will become filled up either by snow or by water coming over the ice surface. The ice being cold will cause the cracks to freeze solid and cement the whole sheet into a firm mass.

When a rise of temperature results, the top surface of the ice will expand while the under face will remain as before, free from strain. This will cause the ice sheet to bend upwards as represented by the dotted figure. Relief cracks will start on the underside, and the ice sheet will remain as before, level on the surface of the water. There is no question but that the under surface cracks will at once fill with water and freeze, so that a permanent increase in the length of the sheet will result.

There seems every reason to believe that an ice sheet may gradually expand by small increments, where the cracks are filled and frozen and hence a permanent thrust will result.

Pressure ridges on large lakes are seldom seen to disappear again, but we believe these are permanently formed by this gradual increase in length of the ice. Working back and forth in these ridges will take place to some extent as was observed by Mr. Sawyer, but we believe these ridges are gradually increased with every great change of air temperature.

Crushing and Tensile Strength of Ice.

Crushing Strength.

One of the authors (H.T.B.) has recently determined the crushing strength of ice and this forms the subject of a separate paper presented to this Society. In that paper it is shown that the crushing strength of clear blocks of St. Lawrence river ice at or near the freezing point is very near to 363 pounds per square inch. This agrees very well with the values assumed by many Engineers, which is in round numbers

400 lbs. per square inch. It was found, however, that the ice block first yielded at approximately half the crushing strength, and that what we have called the crushing strength was the pressure per square inch which caused the ice block to burst.

If we take in round numbers the crushing strength to be 400 pounds, as C. A. Mees has done in his paper on design of dams, then we find with him, that the thrust for various thicknesses of ice can be taken as follows:—

Ice Thickness.	*Thrust in pounds per linear foot.*
6 inches	28,800
8 "	38,400
10 "	48,000
12 "	57,600

Tensile Strength.

The best tests which we have seen on the tensile strength of ice have been made by Mr. George G. Bell (Maine Society of Civil Engineers, Vol. 1, page 41, 1911).

The American Civil Engineers' Pocket Hand Book gives a range of 142 to 223 pounds per square inch.

Mr. Bell employed a cement testing machine. The samples of ice were prepared in two different ways. The first lot by filling cement moulds with water which were allowed to freeze. In these samples the air bubbles arranged themselves perpendicular to the surface of the ice in contact with brass, forming a core in each end, and when tested, failure occurred along the line containing the points of contact, and the core. The second set of samples was prepared by cutting the ice to nearly the proper size. These pieces were set in the moulds and the remaining space filled with water and frozen.

The following table contains Mr. Bell's results:—

TABLE IV.

Results of Tension Tests of Ice. (Geo. G. Bell)

No. of tests.	*Breaking Load in pounds per sq. inch.*	*Temperature.*	*Remarks.*
1.	82	.17F°	Water frozen in cement moulds.
2.	55	"	" "
3.	145	"	" "
4.	105	"	" "
5.	188	"	" "
6.	118	"	" "
7.	137	"	" "
8.	139	"	" "
9.	120	"	" "
10.	160	"	" "
11.	105	"	" "
12.	135	"	" "
13.	135	"	" "
14.	115	"	" "
15.	110	"	" "
16.	129	"	" "
17.	112	"	" "
18.	112	15.°F	Cut from ice.
19.	130	"	" " "
20.	112	"	" " "
21.	155	"	" " "
22.	138	"	" " "
23.	126	"	" " "
24.	118	"	" " "
25.	120	15.F°	Water frozen in cement moulds.
26.	142	"	" "
27.	95	"	" "
28.	90	"	" "
29.	100	"	" "
30.	80	"	" "
31.	116	"	Cut from ice.

Average tensile strength, 120 pounds.

It will be seen that these are all considerably below half the crushing strength. Mr. Bell in describing the effect of ice thrust writes as follows:—

"If ice is floating in water, the temperature of the surface in contact with the water does not fall much below 32°F. The variation of the temperature at any point in the ice is nearly proportioned to the distance from the surface in contact with the water, and is a maximum at the surface in contact with the air.

"The expansion of ice is a function of the change in temperature, so that the tendency to expand is a maximum at the upper surface, and is practically zero at the lower surface. If the ice is restricted at the edges and is exposed to a rising temperature, the upper surface, will be subject to compression. The unit compression decreases as the distance from the upper surface, and is zero at the lower.

"Then the maximum thrust that the ice can exert will be when the upper surface is on the point of crushing. Taking this as 400 pounds per square inch, the thrust per linear foot of a sheet of ice (t) inches thick = t ÷ 2 × 12 × 400 = 2,400 t; that is the thrust of a sheet of ice in pounds per linear foot is the thickness of the sheet multiplied by 2,400.

"Although ice forms in our northern rivers and lakes up to three feet thick, it seems probable that the greatest ice pressures occur when the ice is from a foot to a foot and a half thick,—that being the greatest thickness at which ice reefs are formed. The thrust for a sheet of ice 18 inches thick is 2,400 × 18 = 43,200 pounds per linear foot, for a twenty-inch sheet 2,400 × 20 = 48,000 pounds.

"There are only two references that give actual values of ice thrust. The first is in the discussion of the New Croton Dam by Professor Cain. He states that 'The ice between two bridge abutments 90 feet apart, expanded during a rise in temperature and arched so that the center was three feet above its original level.' He gives the thrust for a 12-inch sheet of ice as 21,000 lbs.

"The second reference is given in Volume 5, Part II, of the Canadian Society of Civil Engineers by Duncan MacPherson, of a bridge pier subjected to ice on one side only, which was shoved out of line two inches, and held there under passing trains until a channel was cut in the ice, when the pier settled back into its original position.

"The thrust of the ice to tip the pier only was given as 14,600 pounds per linear foot for ice 12 inches thick. Taking the train load at 3,000 pounds per linear foot, would bring the thrust up to 18,000 pounds for ice 12 inches thick.

"Probably all that prevented rupture in the first case was that there was not sufficient expansion. However, the thrust of the ice would probably be much greater when the arch was flatter.

"In the second case, the ice had not reached the point of failure, and there is no information given from which to estimate it."

The results are of interest as representing forces actually exerted by the ice, although they do not give the theoretical maximum thrust, which according to accepted notions, would equal 28,800 pounds per linear foot for ice only half as thick. This bears out our ideas of the yielding of ice below the crushing strength.

Mr. Bell states: "The crushing strength of floating ice may be taken at about 10 tons per square foot.

"A bridge pier was shifted by a blow from a large field of ice, and the crushing strength of the ice was figured from the force necessary to replace the pier. This was 11 tons per square foot.

"A careful study of ice reefs and the maximum thickness of the ice at which they form in any locality, together with experiments on long columns of floating ice in the water, would furnish much valuable data. From the present limited data, the writer believes that a dam exposed to the full pressure of ice should be designed to resist from 43,000 to 48,000 pounds per linear foot, and that structures subject to blows from floating ice should be capable of resisting from 10 to 12 tons per square foot, on the area exposed to the greatest thickness of floating ice."

Experiments made by Mr. Bell on the adhesion of ice frozen to concrete surfaces is of much interest and importance. He states:—

"These tests indicate that if ice is firmly frozen to the concrete, it will develop its full crushing strength, irrespective of the inclination of the line of ice to the surface of the concrete, as long as the temperature of the ice is below the freezing point.

"William M. Patton, in his treatise on foundations, says that the adhesion of ice to a pier, even to the sloping surface, may be so great as to develop the full crushing strength of the ice.

"When the natural upper surface of the ice was perpendicular to the line of thrust, the samples fractured horizontally and vertically, when the natural upper surface was parallel to the line of thrust, the samples fractured in parallel vertical planes only.

"In the latter case, if the ice had reached a temperature of thirty-two degrees, it was often impossible to obtain further signs of failure, as the ice under the pressure of five or six hundred pounds per square inch, would spread or flow without further fracture."

Conclusions.

As a result of our study of ice expansion which must be regarded as only preliminary, we find that—

(1) The crushing strength of ice is most probably 400 lbs. per sq. inch, or 28 kilos per sq. cm.

(2) An ice block will yield under pressure at approximately 200 pounds per square inch, which is probably due to the slipping of the crystals.

(3) An ice sheet will form cracks on the upper and under surface due to unequal strain.

(4) That a permanent expansion may result if the cracks become filled and frozen.

(5) According to the most trustworthy results of other observers, the ice frozen to concrete develops its full crushing strength, and the tensile strength of ice is under 200 lbs. per square inch.

"*A Determination of the Coefficient of Expansion of Mercury at Low Temperatures.*"

By C. B. JAMES, B.A., Demonstrator of Physics, McGill University.

Presented by Dr. H. T. BARNES, F.R.S.C.

(Read May 27, 1914.)

In 1817, Dulong and Petit made a measurement of the absolute expansion of mercury from 0°C. to 300°C. using the method of equilibrating columns. This method is based on the principle that if two colums of a U-tube containing a liquid are under the same conditions of pressure, but at different temperatures, then the density of the liquid in the columns will be inversely proportional to the heights. By this method no correction is necessary for the expansion of the containing vessel. One column was enclosed in an ice mixture, and the other was encased in an oil bath heated by a furnace. The temperature was obtained by an air thermometer extending almost the whole length of the bath. No method of stirring was employed. The mean value for the expansion from 0° to 100° as found by Dulong and Petit was $\frac{1}{5,550} = \cdot 00018018$. In 1857, Regnault repeated this work with approved apparatus. As is well known he inverted the U-tube having the horizontal connecting tube at the top and brought the lower ends together. These columns were connected to an air drum and were also kept at constant temperature. Regnault used a hand stirring device to obtain a uniform temperature in the oil bath. The air thermometer was used. With this improved method Regnault found the coefficient of expansion to be $\frac{1}{5,547} = \cdot 00018028$ which does not differ greatly from that given by Dulong and Petit.

In 1910, Callender again improved the apparatus and repeated the work. He used an electrical heater for the oil bath and obtained the temperature by means of the platinum thermometer. Centrifugal circulation driven by an electric motor kept the oil in circulation so that uniformity of temperature was maintained. In place of having a single pair of hot and cold columns as Regnault used, six pairs were connected in series which gave about eight times the expansion obtainable by Regnault. The expansion from −10°C. to

300°C. was directly measured, exterpolated values were given also for temperatures below −10°C. The mean coefficient from 0°C. to 100°C. as found by Callendar was ·000182054.

The object of this investigation was to directly determine the expansion from 0°C. down to the freezing point of the mercury by means of the method of the weight thermometer.

A marked increase in the contraction of the mercury near its freezing point was looked for in view of the theory that solid molecules are mixed with the liquid. On this theory is based the explanation of the anomaly of the point of minimum specific heat of water at 40°C., as found by Prof. Barnes. For mercury likewise it is assumed that there are solid molecules present at all temperatures from the freezing point where there is a maximum number to the boiling point, for the specific heat of mercury decreases rapidly with temperature between these limits.

In the case of mercury, however, the solid is more dense than the liquid, resulting in a contraction on freezing. The effect of the solid molecules on the volume of the mercury would be to cause a more rapid contraction in the neighbourhood of the freezing point provided these particles were produced in greatly increased numbers at the low temperature. The theory of solid molecules has also helped to explain the maximum density point of water. We would therefore expect an increase in the contraction of the mercury near its freezing point.

Apparatus and Method Used.

Some special dilatometers of fused quartz were constructed for us. These were approximately 100 c.c. capacity fitted with special small overflow tubes of about 1 mm. bore. Two of these dilatometers were filled with pure redistilled mercury. The final values were, however, obtained with only one of these, as the second one filled was accidentally broken before measurements could be made with it.

A special thermostat was constructed after many trials of different forms. This worked so satisfactorily that we describe it here in some detail.

A diagram of the thermostat is shown in Fig. 1.

The containing bath V, was fitted with an auxiliary tube A, fitted with a rotating worm N. This bath was packed in an outer case W, with glass wool. Lead tubing K, was wound around the bath and connected to the top with a reservoir containing liquid air L. This reservoir was a Dewar bulb with an outlet at the bottom as shown. The lower end of the lead tube was connected with a three way cock M,

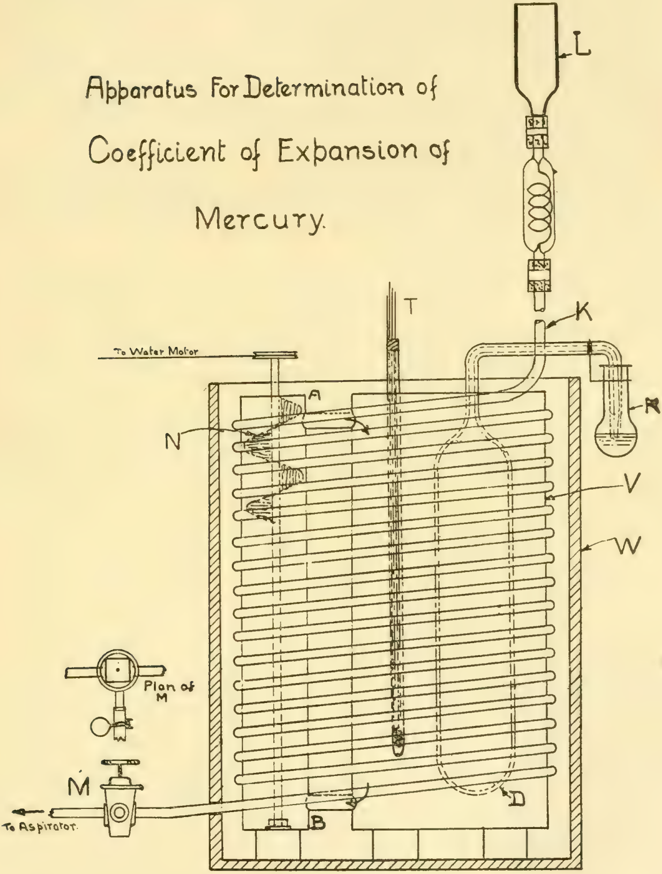
Apparatus For Determination of
Coefficient of Expansion of
Mercury.
L
T
K
To Water Motor
A
R
N
V
W
Plan of
M
M
D
To Aspirator.
B

Figure 1.

a plan of which is shown. A water vacuum pump was connected to M, in order to cause the liquid air to flow through the lead tube. By adjusting the third-way of the tap by means of a pinch cock, so as to admit more or less air, the quantity of liquid air drawn through could be regulated to any degree of fineness.

As a fluid for the bath we used methylated spirits. This enabled us to obtain steady temperatures as low as –90°C. without any serious increase in the viscosity of the spirits. A water motor, run at a high speed, caused excellent circulation of the spirits in the bath around the bulb of the dilatometer D.

A platinum resistance thermometer T, enabled us to measure the temperature of the bath. The bath could be maintained constant to 1/100 of a degree at any desired temperature down to the freezing point of the mercury.

Theory of the Method.

The theory of the weight dilatometer may be stated as follows:—

Let V_o = volume of fluid and dilatometer at 0°C.

V_t = volume of dilatometer at t°C.

α = absolute expansion of the fluid.

g = absolute expansion of them aterial of the dilatometer.

ρ_o = density of the fluid at 0°C.

then

$$V_t = V_o (1 + g\ t)$$

$$\rho_o = \rho_t (1 + \alpha\ t)$$

We have

$$V_t{}^1 \rho_t = M_t \ldots\ldots\ldots\ (1)$$

$$V_o \rho_o = M_t + m \ldots\ldots\ (2)$$

where m = the mass of fluid expelled at a temp. t°C.

From 1 and 2 we have

$$\frac{1 + \alpha\ t}{1 + g\ t} = \frac{M_t + m}{M_t}$$

From this we have $1 + \alpha\ t = \dfrac{M_t + m}{M_t} + \dfrac{M_t + m}{M_t} g\ t$

But $\dfrac{M_t + m}{M_t} = 1 + \dfrac{m}{M_t}$

therefore $\alpha\ t = \dfrac{m}{M_t} + \dfrac{M_t + m}{M_t} g\ t$

hence $\alpha = \dfrac{m}{M_t\ t} + \dfrac{M_t + m}{M_t} g$

which is the formula used for calculation.

It remains to select a suitable value for g in the case of fused quartz.

Much work has been done recently on the coefficient of absolute expansion of quartz. A careful summary of this has been given by N. E. Wheeler in a special communication to the Royal Society of Canada. It is, therefore, unnecessary to go into a complete discussion of the conclusions in the present paper.

The most accurate values given by Wheeler may be taken as

$0{\cdot}488 \times 10^{-6}$	between	$0°$ and $100°$C.
$0{\cdot}325 \times 10^{-6}$	"	$-20°$ and $0°$C.
$0{\cdot}307 \times 10^{-6}$	"	$-30°$ and $0°$C.
$0{\cdot}295 \times 10^{-6}$	"	$-37°$ and $0°$C.

for the linear coefficient of quartz. We have, therefore, assumed these values in correcting for the expansion of our quartz dilatometer and have taken the cubical as three times the linear experimental values.

The overflow from the dilatometer was determined by the ordinary method. The constancy of the total weight at 0°C. gives us an indication of the fact that no permanent change in the volume of the dilatometer resulted from successive heating and cooling. These measurements are as follow:—

Feb. 5th.	1527·16	gram.
Feb. 10th.	1527·11	"
May 7th.	1527·18	"
May 13th.	1527·15	"

Preliminary experiments were made to determine the mean coefficient of expansion of mercury between 0° and 100°C. The dilatometer was immersed in a carefully prepared ice mixture with the stem dipping into mercury held in the overflow receptacle. After one hour, when a steady temperature was reached, the dilatometer was suspended in a hypsometer and supported by a wire holder in such a way as to swing free of the sides. Before placing in steam the overflow receptacle was replaced by a carefully weighed empty vessel. The time for immersion in steam was one hour. Careful readings of a standard Fortin barometer were made during this time. The following values were obtained:

Date.	Temp. of steam.	Overflow grams.	Weight at 100°C. grams.	Coefficient neglecting the quartz.
May 13	99·986°C.	27·1248	1500·04	·00018081
" 16	99·79°C.	27·0869	1500·04	·00018100
" 26	99·975°.	27·1495	1500·04	·00018100

The mean of these gives for the mean coefficient between 0° and 100°C. neglecting the expansion of the quartz—

·00018094

Correcting for the quartz by using the value assumed above between 0° and 100°

$$\alpha = \cdot 00018241.$$

Experiments at the Lower Temperatures.

The dilatometer was suspended in the thermostat by the wire holder. The stem, as before, was kept with the mouth dipping in mercury held in the overflow vessel. The thermostat was then cooled and held at the desired temperature for at least an hour. For the lowest point no readings could be taken below –38°C. owing to the freezing of the mercury which was observed to take place. We, therefore, did not include any measurements which went below –37·5°C.

After obtaining the desired temperature the overflow vessel was replaced by one containing a known mass of mercury. The dilatometer was then lifted out of the thermostat and all methylated spirits wiped from the surface. It was then placed in the ice bath and left for at least an hour. The difference in the weight of the mass of mercury contained in the overflow vessel was obtained, which gave us a measure of the expansion without danger of sucking back air into the dilatometer in case the removal of the spirits should cause the temperature of the dilatometer to exceed 0°C. before the final reading was obtained.

The following readings were obtained:—

Date	Temp. of thermostat	Weight of overflow	Coefficient
1913			
May 8	−20°·00C.	5·5044	·00017976
" 13	−20·00 C.	5·4947	·00017951
" 17	−19·68°C.	5·430	·00017958
" 31	−29·75°C.	8·1885	·00017938
" 31	−29·60	8·1582	·00017940
June 4	−36·75°C.	10·1248	·00017901
" 4	−37·50°C.	10·3086	·00017900

The weight at zero was taken as 1527·16 grams. Taking the mean value, we find:

Temp. range.	Coefficient uncorrected.	Coefficient corrected.
−20 to 0°C.	·00017962	·00018059
−30 to 0°C.	·000179389	·00018030
−37 to 0°C.	·000179005	·00017988

Comparing these results with those of other observers we shall confine ourselves to those of Callendar and Moss, by Dulong and Petit's method, and those of Callendar and Harlow, by the quartz dilatometer. The following table gives these values:

Temp. range	Callendar and Moss	Callendar and Harlow	James
−0 to 100°C.	·000182054	·00018244	·00018241
−20 to 0°C.	·000180317 Exterpolated from formula	....	·00018059
−30 to 0°C.	·00018025	....	·00018030
−37 to 0°C.	·0001801	....	·000179881

It will be seen that we are in good agreement with the determination of the quartz dilatometer of Callendar and Harlow, but disagree with the determination of Callendar and Moss. The last three results of Callendar and Moss are exterpolated values from Callendar and Moss formula which was deduced from observations extending to −10°C. only.

Our results do not show any very large change in the coefficient although it falls off more rapidly than the exterpolation formula of Callendar.

On a Determination of Avogadro's Number and the Electronic Charge by the Application of Rayleigh's Law to the Smithsonian Observations of the Absorption of Solar Radiation by the Earth's Atmosphere.

By LOUIS V. KING, B.A., Assistant Professor of Physics, McGill University.

Presented by Professor H. T. BARNES, F.R.S.

(Read May 27, 1914).

The bearing of Rayleigh's Law of gaseous extinction on some of the fundamental aspects of radiation theory does not seem to have been sufficiently emphasized in recent reports and publications on modern molecular physics. The coefficient of attenuation κ of radiation of wave-length λ travelling through a gas containing n_0 molecules per unit volume was given by Rayleigh[1] as long ago as 1871 in the form $\kappa = \frac{8}{3}\pi^3 (\mu_0^2 - 1)^2 \lambda^{-4}/n_0$, μ_0 being the refractive index of the gas. It is of importance to notice that the law in question is one of the most fundamental results of molecular dynamics, its final expression being an invariant with respect to the theories of the æther or of the molecule employed,[2] while in its derivation there is no need to draw on resources outside classical dynamics and continuous energy-flow. From the point of view of elementary electromagnetic theory, the above expression for κ is very easily derived along lines suggested in a problem set in Part II. of the Mathematical Tripos[3]: use is made of the conventional electrical doublet set into forced vibrations by a train of electromagnetic waves; by making use of the radiation formula for accelerated charges and Poynting's Theorem, the flow of energy from the doublet is easily calculated in terms of the amplitude of vibration; the oscillations of the doublet contribute a term to Maxwell's displacement current, enabling the amplitude to be expressed in terms of the refractive index of the gas; by considering the depletion of energy from the original beam as a result of this scattering, and eliminating the amplitude, the above expression for κ is easily obtained. In a recent paper Natanson has subjected the derivation of Rayleigh's Law to minute criticism

[1] Rayleigh, *Phil. Mag.* 41, pp. 107, 274, 447 (1871); "Collected Works" I, pp. 87, 104, 518.

[2] Schuster, "Theory of Optics," 2nd ed. (1909), p. 325.

[3] Mathematical Tripos, Part II., June 2, 1906.

on the grounds of the classical electromagnetic theory, allowing for a damping term arising from the mechanical reaction due to radiation and taking into special consideration the summation of the aggregate radiation from the random distribution of doublets which are supposed to constitute the molecules of the gas; the final result is a vindication of the above expression for the coefficient of attenuation to a very high order of accuracy.[1] It may be noticed in passing that the same electromagnetic system forms the basis of Planck's[2] theory of "black body" radiation, the interpretation of experiment in this case, however, necessitating the hypothesis of discontinuous energy-flow, or the emission of energy by "quanta."

For an adequate experimental verification of Rayleigh's Law, recourse must be had to observations on the extinction of solar radiation of different wave-lengths by the earth's atmosphere. The importance of the observations of the Smithsonian Astrophysical Observatory on atmospheric transmission recently carried out by Abbot and Fowle[3] in connection with their determinations of the solar constant at Mount Wilson, in furnishing material for a study of molecular scattering was first pointed out by Schuster[4]; the question was examined in further detail by Natanson[5] and independently by the writer.[6]

If S refer to the intensity of wave-length λ outside the earth's atmosphere and E (x) to the intensity normal to the sun's rays reaching a level x above the sea from a zenith distance ζ, we have $E(x) = Se^{-C_x \sec \zeta}$, where C_x is the coefficient of attenuation at the station in question. If allowance be made for the conversion of radiant energy into heat, it is shown by the writer that C_x may be expressed in the form $C_x = \gamma + \beta\lambda^{-4}$; β is proportional to the pressure of the atmosphere so that if β_0 refer to standard conditions of pressure and temperature we have $\beta_0 = \beta p/p_0$, where p is the barometric pressure at the station at the time of observation. Finally, in terms of the refractive index of air under standard conditions, it is shown that $\beta_0 = \frac{8}{3}\pi^3(\mu_0^2 - 1)^2 H_0/n_0$, where H_0 is the height of the "homogeneous atmosphere" calculated at 0°C. and n_0 the number of molecules of air per cm.[3] under standard conditions. It

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[1] Natanson, *Bull. Inter. de l'Acadêmie des Sciences de Cracovie*, Jan. 5, 1914.

[2] Planck, "Theory of Heat Radiation," (Trans. by Masius, Blakiston's, Philadelphia, 1914), Part IV., Chapt. III, p. 165.

[3] Annals of the Smithsonian Astrophysical Observatory, Washington, Vol. II, (1908); Vol. III (1913).

[4] Schuster, "Nature," July 22, 1909: "Optics," 2nd ed., 1909, p. 329.

[5] Natanson, *Bull. Inter. de l'Academie des Sciênces de Cracovie*, Dec. 13, 1909.

[6] King, Phil. Trans. Roy. Soc. 212A, p. 392, 1912.

may be remarked that these relations may be obtained in a very general manner independently of any assumptions regarding the atmospheric gradients of temperature and pressure, provided that the planes of equal density be parallel to the earth's surface.

The accuracy of the experimental measure of the zenith transmission $a = e^{-C_x}$ rests ultimately on the ratio of two galvanometer deflections, or the measurements of two ordinates of a bolograph record, quantities measurable to well within one per cent. Owing to the occurrence of the *ratio* only, corrections due to the imperfect reflecting powers of mirrors, absorption by prisms, slight refection from the bolometer-strip, etc., do not appear. The determination of the remaining observed quantities, zenith distances of the sun, wave-lengths and barometric pressures are all measurable to a high degree of accuracy, so that it does not seem too much to say that the zenith transmission can be determined over a considerable range of wave-lengths to an accuracy well within one per cent.

Data on atmospheric extinction recently made available by the publication of Vol. III. of the "Annals" of the Smithsonian Astrophysical Observatory are given in terms of the zenith transmission a, for the most part over a range of ten wave-lengths, avoiding regions of selective transmission. The average zenith transmission $\bar{a}$ is determined for a large number of days each year; unfortunately it is not quite exact to derive the mean coefficient of attenuation as $\log_\epsilon \bar{a}$; the error committed is difficult to estimate beforehand but will be negligible only when the attenuation coefficients are small or when they deviate very little from their mean value; actual trial shows that the error committed may amount to as much as 2 or 3 per cent. In addition, there is the probability that the constants β and γ are independent variables; for these reasons it seemed advisable to the writer to determine β and γ independently from each day's observations from the constants of the line of closest fit (calculated by least squares) corresponding to the formula $C_x = \gamma + \beta\lambda^{-4}$, taking as variables C_x and λ^{-4} measured in units chosen according to a suitable scale. The computations were very ably carried out by Mr. A. A. Scott, M.Sc., and Mr. Etienne S. Bieler, both of McGill University, working under a grant from the Rumford Fund of the National Academy of Sciences. The daily determinations of β and γ have now been extended to all the transmission observations as yet published by the Smithsonian Astrophysical Observatory. Comparison with theory is most conveniently made by calculating n_0 according to the preceding formulæ. For each selection of wave-lengths a value of $(\mu_0 - 1)^2$ weighted according to λ^{-4} was employed, while the baro-

metric pressures at the times of observation were obtained through the courtesy of Dr. Abbot.

Pending full publication and a more detailed discussion of the results obtained, a summary of the mean values of β and γ together with the corresponding determinations of n_0 and the probable deviation from the mean is given in the following table.

Constants of Atmospheric Absorption.

Mount Whitney, California. Elevation, 4420 metres. Average Barometer, 446·7 mm.

Annals Vol.	Table	No. Days	Mean γ	Mean β	Mean N_0	Wave-lengths.
III	46	4 (1909-10)	·014 ± ·003	·0049 ± ·0001	$(2·84 \pm ·06) \times 10^{19}$	10 wave-lengths ·327μ to ·574μ

Bassour, Algeria. Elevation, 1160 metres. Mean Barometer, 664·6 mm.

Vol.	Table	No. Days	Mean γ	Mean β	Mean n_0	Wave-lengths
III	46	9 (1911-12)	·080 ± ·012	·00723 ± ·0002	$(2·85 \pm ·07) \times 10^{19}$	10 wave-lengths ·340μ to ·532μ.
III	46	2 (1912)	·27 ± ·01	·00696 ± ·0001	(2·96 ± ·03)	

The marked increase of γ in the second series at Bassour is due to the presence of volcanic haze from the Mount Katmai eruption, June 6-7, 1912.

Mount Wilson, California. Elevation, 1780 metres. Mean Barometer, 623·5 mm.

Vol.	Table	No. Days	Mean γ	Mean β	Mean n_0	Wave-lengths
II	14	59 (1905)	·052 ± ·002	·00673 ± ·00011	$(2·82 \pm ·04) \times 10^{19}$	4 wave-lengths ·40μ ·45μ ·50μ and ·60μ.
II	14	62 (1906)	·058 ± ·002	·00613 ± ·00006	(3·10 ± ·03)	
III	33	114 (1908)	·076 ± ·002	·00691 ± ·00006	(2·75 ± ·02)	9 wave-lengths. ·35μ ·40μ ·45μ ·50μ ·70μ ·80μ 1·00μ 1·20μ 1·60μ
III	34	96 (1909)	·031 ± ·001	·00687 ± ·00008	(2·80 ± ·03)	
III	35	115 (1910)	·023 ± ·001	·00696 ± ·00008	(2·76 ± ·02)	
III	36	113 (1911)	·022 ± ·001	·00696 ± ·00005	(2·76 ± ·02)	

The mean value of n_0 obtained by combining the results of Tables 34, 35, and 36 (324 days, 1909-11) gives $n_0 = (2·78_1 \pm ·01_3) \times 10^{19}$. Hence we obtain for Avogadro's Number the value $N = (6·23 \pm ·03) \times 10^{23}$ and for the charge on the electron $e = (4·64 \pm ·02) \times 10^{-10}$ e.s. units.

The above determination of n_0 compares favourably with Rutherford's[1] 2·78, Planck's[2] 2·77, and Millikan's[3] ($2{\cdot}705{\cdot}00 \pm 5$), while the value recently obtained by Fowle[4] from a somewhat different treatment of the Mount Wilson data gave 2·56.

Taking as the volume of a molecule-gramme the value 22412 at 0°C. and 760 mm., Avogadro's Number is given by the relation[5] $N = 22412 \times n_0$, from which we obtain $N = (6{\cdot}23_3 \pm {\cdot}02_8) \times 10^{23}$. Taking the atomic weight of silver to be 107·88 and its electrochemical equivalent to be 1·11800 mgm. per coulomb, we have $Ne = (107{\cdot}88) \div (1{\cdot}11800) \times 10^2$, where the electronic charge is measured in e.m. units; we thus easily obtain the final result $e = (4{\cdot}64_4 \pm {\cdot}02_1) \times 10^{-10}$ e.s. units.

Although the above reductions of a series of self-contained observations on atmospheric extinction yield a determination of n_0 to an order of accuracy not very much less than that of the best existing determinations, their chief interest lies in the fact that they constitute as rigorous an experimental test of Rayleigh's Law as may be expected in view of the practical impossibility of securing absolutely perfect atmospheric conditions. From the value of γ may be calculated the fraction of radiant energy converted per centimetre of path into thermal molecular agitation ; taking a value $\gamma_0 = {\cdot}032$ for air under standard conditions it is easily shown that in a stream of radiation corresponding to the solar constant the rate of increase of temperature amounts to ·015°C. per hour.[6] As the above value of γ, even for the comparatively dust-free air above Mount Wilson, includes to a certain extent the effect of volcanic haze, it follows that in a pure gas partition of energy cannot take place at a rate greater than is represented by the above-mentioned rate of increase of temperature. We have in this case an excellent illustration of two interpenetrating dynamical systems (the aetherial system of electromagnetic waves and the molecular gaseous system) allowing of partition of energy, if at all, at an excessively slow rate compared to the rate of equilization of energy distributions which is capable of being realized in each system considered separately. It is interesting to notice also that this rate is enormously increased by the presence of constrained molecular

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[1] Rutherford, E., and Geiger, H., Roy. Soc. Proc., A, Vol. 81, 1908, p. 171.

[2] Planck, *loc. cit.*, p. 172.

[3] Millikan, *Phys. Rev.* 2, Ser. 2, pp. 109-143, Aug. 1913. *Phys. Zeitschr.* 14, pp. 796-812, Sept. 1, 1913.

[4] Fowle, *Astrophysical Journal*, 38, No. 4, p. 398, Nov. 1913.

[5] The values of these fundamental constants are those recently given by Kolowrat, "Le Radium," II, i., p. 1, Jan. 1914.

[6] King, loc. cit. p. 394

systems (matter in the solid or liquid state such as dust-particles, water droplets, etc.)

Further, the experimental verification of Rayleigh's Law to a high degree of accuracy is interesting in that its final expression is a result of classical dynamics and continuous absorption and re-emission of energy; from this point of view it seems to the writer that the hypothesis of emission by "quanta" cannot be universally applied to radiating molecular systems.

In this connection it is interesting to notice that in the recent theory of specific heats as proposed by Debye, Born[1] and Kàrmàn,[2] and now generally recognized as an adequate interpretation of experimental results, the interpretation of Planck's constant *h* has been transferred from association with the individual atom to the process whereby energy is interchanged between molecular systems vibrating under those intramolecular forces and constraints which in their integrated form determine the elastic properties of the solid state. Similarly in view of the above-mentioned verification of Rayleigh's Law it is difficult to see how Planck's "quantum" can be associated with the individual molecule, at any rate for that system of vibrations which enter into the forced oscillations with consequent re-emission of radiant energy thus constituting the phenomenon of molecular scattering. In the opinion of the writer one might with advantage seek for the interpretation of Planck's *h* in the problem of "black-body" radiation in the fact that the radiating units probably perform vibrations under the intramolecular forces and constraints which determine the solid state, while at the same time the reaction of the total aggregate of radiating systems must profoundly modify the character of the radiation from the original sources before it emerges from the interior of the solid into free space for experimental examination.

Louis V. King.

McGill University, June 6, 1914.

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[1] Debye, *Ann. der Phys.* (4), 39, p. 789 (1912).

[2] Born and Kàrmàn, *Phys. Zeitschr.* 14, p. 15; also, p. 65 (1913).

Transactions of The Royal Society of Canada
SECTION III

SERIES III SEPTEMBER 1914 VOL. VIII

The Vapour Pressures of the Halogen Hydrides and of Hydrogen Sulphide.

By O. MAASS AND D. MCINTOSH, F.R.S.C.

(Read May 27, 1914).

In a paper on the halogen hydrides (Phil. Trans. Roy. Soc., A, 205 p. 99, 1905), Steele and McIntosh have given their determinations of the vapour pressures of these liquids between their freezing and boiling-points. Since the halogen hydrides and hydrogen sulphide act, even when carefully dried, on the mercury of a manometer an apparatus was devised to prevent their contact with mercury by means of an inert gas. The method was, apparently, a satisfactory one, and the results obtained were probably nearer the correct values than those of previous experimenters.

In our study of these liquefied gases we have noticed that they show the phenomenon of supercooling to a remarkable degree, so that the values found may differ markedly from the true vapour pressures unless the liquid is kept at a constant temperature for a long time.

We have, therefore, redetermined these vapour pressures using the beautiful method devised by Johnson (Zeit. physik. Chem. 61,457, 1908), in which a spiral is used as manometer so that the corrosive gas comes only in contact with glass. We have also improved our constant temperature bath so that we believe our results are correct to 0·2°C.

APPARATUS AND METHODS.

In making mercury manometers it is customary to fill the inverted tube with mercury and to remove any gas or water vapour by heating the apparatus and reducing the pressure over the mercury. As this usually results in a scum forming on the surface of the mercury, we have filled our manometers in the following way: A distilling flask containing pure mercury was attached to either the short or long arm of the manometer, both of which were connected to a Toepler pump. The pressure was reduced to 0·0005 mm., and after the whole apparatus was heated by a Bunsen burner the mercury was distilled

slowly into the manometer. From time to time the pressure was measured by means of a McLeod gauge and kept below one-half a micron by the pump. After three months no difference could be detected between manometers in use and one recently made; the surface of the mercury remained perfectly clean. (Fig. 1.)

Our constant temperature bath (Fig. 2) consisted of a three inch cylindrical Dewar flask, silvered except for two strips on opposite sides so that the contents might be easily seen. Ether and solid carbon dioxide were used as the bath liquid, and with a May-Nelson pump temperatures between —80° and —116°C could be obtained. At these low temperatures the bath warmed one degree in 25 minutes, but by regulating the pressure over the carbon dioxide the temperature could be kept to 0·1°. The bath was stirred by forcing in dry air through the tube C. Such an arrangement will be found satisfactory only when a relatively small amount of solid is present. The mixture must not be viscous.

The hydrogen thermometer was of the well known Travers' type, and was filled with hydrogen from palladium. Its ice-point was determined from time to time. By forcing the mercury up into the vacuum tube gases liberated from the walls were pushed into a "trap" and there retained.

The hydrides were made in the ordinary ways and dried[1] by phosphorus pentoxide. They were fractionated three times in vacuo, the middle portions only being retained, and were finally distilled into the vapour pressure bulb E. They were then frozen by liquid air and the apparatus was exhausted to 0·01 mm. by the Toepler pump. They were melted, re-frozen, the system re-exhausted and finally sealed off from the pump. The gases came in contact only with the glass of the tubes and of the spiral.

The spiral and method of using it have been described fully by Johnson. With our apparatus 0·8 mm. on the manometer corresponded to one millimeter on the scale. As the scale could be read to 0·1 mm. pressures could be determined to 0·08 mm. On account of the variations in the temperature of our bath, we have thought it best to give our results only to the nearest millimeter.

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[1] The minute amounts of phosphorus compounds formed are removed during the distillation.

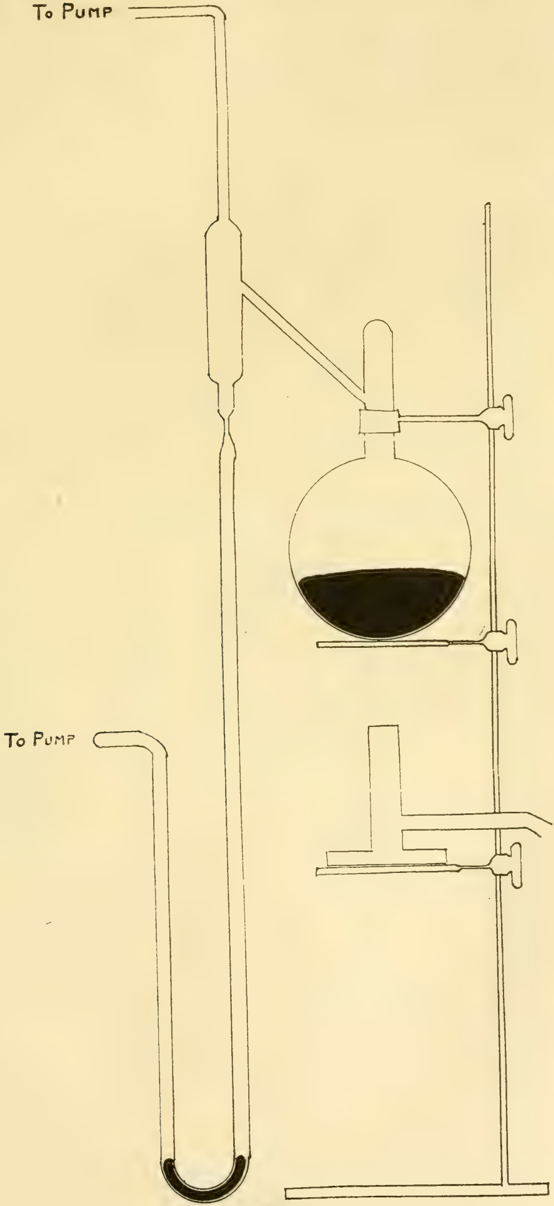


Fig. 1

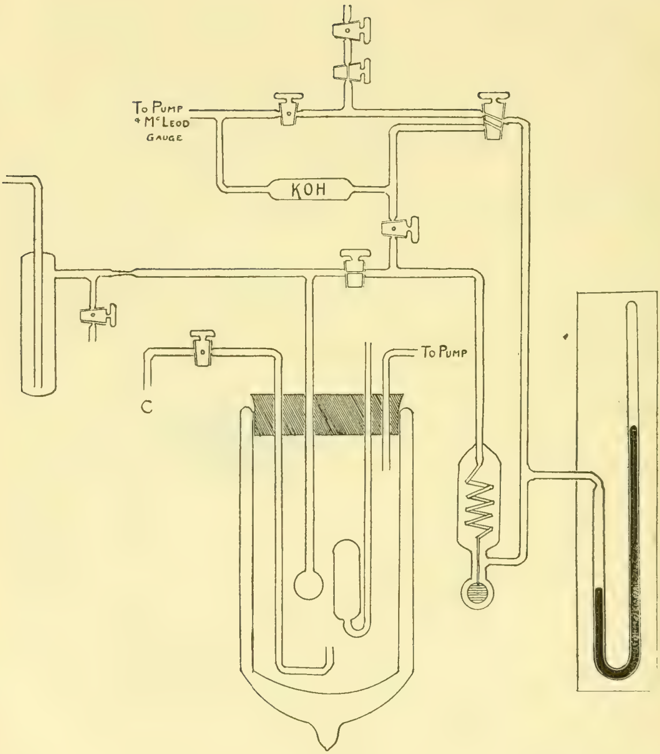


Fig. 2

The results of the measurements are given in Tables 1, 2, 3, and 4, and are shown in the curves (Fig. 3). The measurements, except in the case of hydrochloric acid, have been continued far below their freezing points. It will be noticed that the change in curvature at the melting-point is slight.

TABLE 1.

Hydrochloric Acid.

Temperature	Pressure (cm.)	Temperature	Pressure.(cm.)
−112·5	10·5	94·9	41·3
110·4	12·6	93·9	43·7
106·1	17·5	93·2	45·8
105·2	18·8	92·5	47·5
104·1	20·5	91·2	51·5
103·0	22·7	90·2	53·8
102·0	24·8	89·4	56·8
101·3	26·2	88·6	59·7
100·2	28·1	88·2	61·4
99·4	30·7	86·7	66·9
97·9	33·5	86·2	69·1
96·6	36·6	84·1	76·1
95·9	38·6	83·6	79·5

TABLE 2.

Hydrobromic Acid.

Temperature	Pressure (cm.)	Temperature	Pressure (cm.)
−114·4	2·2	86·8	25·6
113·6	2·4	86·5	26·9
111·6	3·2	85·8	27·9
109·4	4·1	79·0	39·7
106·5	5·5	75·6	47·9
103·2	7·7	73·9	52·3
101·4	9·1	73·2	54·3
99·8	10·4	72·1	57·7
98·2	11·8	71·4	60·3
96·5	13·2	70·2	63·1
94·9	14·5	69·4	66·9
92·9	17·0	68·5	69·9
91·5	19·5	67·6	73·0
88·3	24·1	66·6	77·2

TABLE 3.

Hydrosulphuric Acid.

Temperature	Pressure (cm.)	Temperature	Pressure (cm.)
−110·0	1·8	82·0	17·3
106·1	2·6	80·9	18·8
102·7	3·5	78·4	25·4
99·7	4·3	75·2	31·7
97·3	5·3	72·9	36·6
94·8	6·5	72·0	39·3
92·5	7·6	67·9	48·8
90·6	9·1	64·7	57·3
87·7	11·2	61·9	67·4
86·4	12·6	60·1	73·2
84·6	14·2	58·1	82·2
82·9	15·8		

TABLE 4.

Hydriodic Acid.

Temperature	Pressure (cm.)	Temperature	Pressure (cm.)
−106·9	0·32	79·9	5·7
106·4	0·35	74·1	8·5
104·9	0·49	70·8	10·5
102·8	0·68	66·6	14·0
101·1	0·75	60·7	20·5
98·3	1·1	56·3	26·2
94·2	1·6	50·9	36·8
92·0	2·1	50·3	37·6
89·8	2·3	47·2	44·2
86·9	2·8	43·5	53·1
85·2	3·6	38·8	66·4
82·5	4·6	34·3	80·1

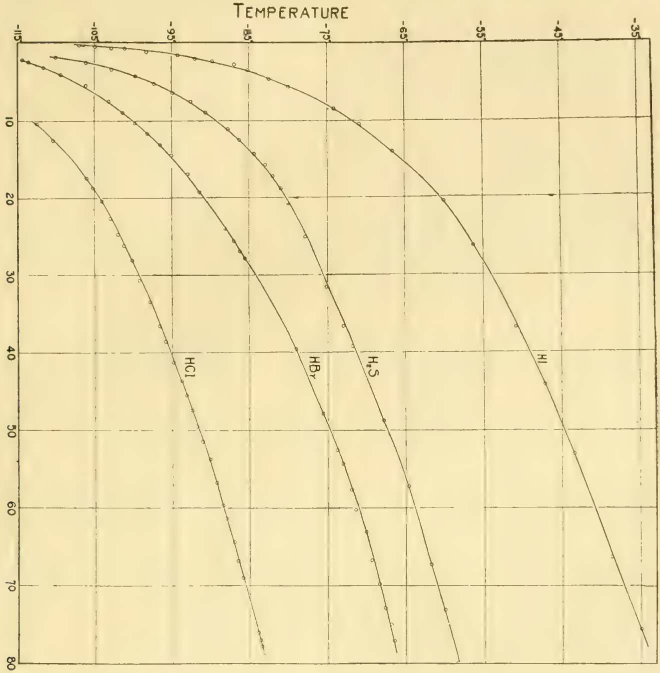


Fig. 3

The melting and boiling-points found by us are given in Table 5 together with the measurements made by other observers.

TABLE 5.

	HCl	HBr	H_2S	HI	
Melting-points	−112·0	86·0	83·8	50·6	(1)
	—	86·0	—	50·8	(2)
	111·1	88·5	—	50·8	(3)
	111·3	86·1	82·9	51·5	(4)
Boiling-points	84·1	66·8	59·4	35·6	(1)
	82·9	68·7	60·2	35·7	(2)
	83·7	64·9	—	34·1	(3)
	83·1	68·1	60·4	36·7	(4)

(1) Maass and McIntosh.

(2) Steele and McIntosh *loc. cit.*

(3) Estericher, Zeit. physik. Chem. 20,605 (1896).

(4) Ladenburg and Krügel, B.B., 33,637 (1900).

Heats of Evaporation.

Clausius has shown that the heat of vaporisation of a liquid may be calculated from the equation,

$\frac{I}{P}\frac{dP}{dT} = \frac{W}{RT^2}$, where $\frac{dP}{dT}$ represents the change of vapour pressure with temperature, P the pressure, T the temperature on the absolute scale, R the constant of the gas equation, and W the heat of vaporisation of one gram molecule of the liquid.

The value of W at atmospheric pressure calculated from the curves (Fig. 3) and the direct determinations of Elliot and McIntosh are given in Table 6.

Table 6.

	Calculated.	Determined.
HCl	14·8	$14{\cdot}9 \times 10^{10}$ ergs.
HBr..........	18·7	17·3 "
H_2S..........	19·5	19·6 "
HI...........	21·6	18·8 "

Two points noticed during the progress of this work may be recorded. A paste of carbon dioxide and ether gives a remarkably constant temperature of —78·2 at atmospheric pressure; but if very cold ether be used the temperature may fall several degrees. Hydrogen iodide distilled in a vacuum and solidified by carbon dioxide is a glass. On warming a few degrees, crystallization begins and spreads through the whole mass.

We wish to express our thanks to Dr. F. M. G. Johnson for the use of a sensitive spiral and for many practical hints which enabled us to avoid mistakes in its use.

Macdonald Chemistry and Mining Building,
McGill University, October, 1913.

Records of the Difference of Temperature between Mount Royal and McGill College Observatory.

BY PROFESSOR C. H. MCLEOD AND PROFESSOR H. T. BARNES.

(Read May 27, 1914).

In continuation of the reports[1] which we had the honor to submit to Section III, we have pleasure in giving herewith the results of our temperature records obtained during the year past.

The records are complete for each month, with the exception of July, which is too incomplete to give a satisfactory average.

The averages for each month are computed from the curve of difference, taking values for each hour of the day.

The great majority of the values show colder on the mountain but occasional large inversions help to reduce the differences.

The following table includes the differences together with the differences representing the deviation of each month, from the records at the observatory for the past 39 years.

TABLE OF DIFFERENCES.

	1913		1914	
Month	Mountain difference	Seasonal difference	Mountain difference	Seasonal difference
Jan.	− 1·493	+10·0	−2·559	−0·37
Feb.	. . . . .	−3·67	2·629	−7·28
March	1·965	+3·55	3·308	+2·22
April	2·587	−4·66	3·770	−2·87
May	3·514	−1·23		
June	3·983	−0·88		
July	. . . . .	+0·35		
Aug.	2·469	−0·22		
Sept.	1·825	−1·78		
Oct.	2·980	+4·52		
Nov.	3·836	+6·25		
Dec.	2·892	+7·30		

NOTE.—When the difference appears as positive it means that the average temperature for that month has been above the average for the same month during the past 39 years.

[1] Trans. Roy. Soc. Can., Vol. X (3) 71, 1904; Vol. XII (3) 141, 1906; Vol. I (3) 3, 1907; Vol. II (3) 157, 1908; Vol. VII, 151, 1913.

In our communication of last year we gave the differences from November, 1912, to April, 1913.

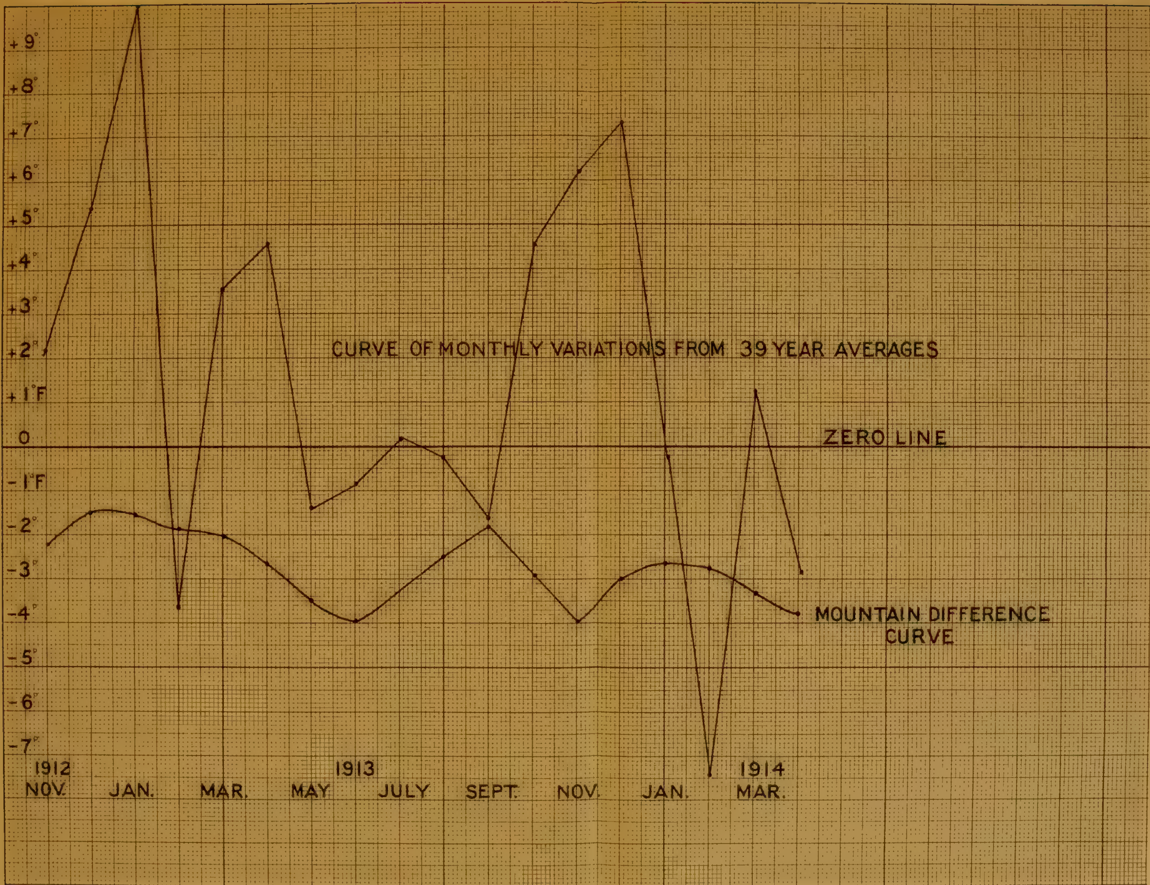
The values so given for the two months of 1912 not included in the above table are:

1912	Mountain	Seasonal
November...........	$-2 \cdot 125$	$+2 \cdot 17$
December	$-1 \cdot 367$	$+5 \cdot 35$

It is our aim to show that relations exist between the mountain differences and the seasonal variations. Our previous series of records showed us that some such relation appeared to exist, but unfortunately the break in the cable destroyed the continuity of the observations. At the present time our records have not been sufficiently continued to give us definite results. It is interesting to plot the observation of the table when it may be seen that in general a small mountain difference is related to a higher seasonal average. It is quite remarkable to observe how characteristic are the various records for each day of the kind of weather condition. As we have pointed out before, an approaching change to warmer conditions is shown usually by an inversion of temperature, several hours previous to the temperature rise at the lower station. The same holds in general for the approach of colder conditions.

Dull, rainy or snowy weather gives us uniform difference curves, which show very small and rapid fluctuations.

We wish to thank Mr. A. A. Scott, M.Sc., for help in computing the monthly averages



CURVE OF MONTHLY VARIATIONS FROM 39 YEAR AVERAGES
ZERO LINE
MOUNTAIN DIFFERENCE CURVE
+9°
+8°
+7°
+6°
+5°
+4°
+3°
+2°
+1°F
0
-1°F
-2°
-3°
-4°
-5°
-6°
-7°
1912
NOV.
JAN.
MAR.
MAY
1913
JULY
SEPT.
NOV.
JAN.
1914
MAR.

The Dawson Isothermal Layer of Low Temperature in the Gulf of St. Lawrence.

By H. T. BARNES, D.Sc., F.R.S.

(Read May 27, 1914).

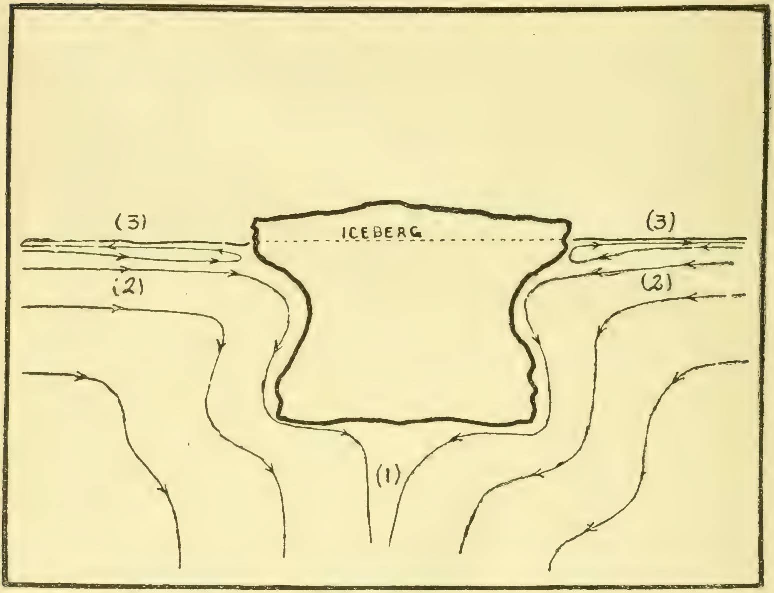
It has been shown by Dr. W. Bell Dawson during his very careful temperature survey of the Gulf of St. Lawrence, that there exists a layer of low temperature at a depth of approximately 30 or 40 fathoms. This layer underspreads the whole area of the Gulf, and that part of the Labrador current southeast of Newfoundland where Dr. Dawson's measurements were taken. The temperature of this layer remains apparently fairly constant the year round at about 30°F. The interesting part of this remarkable phenomenon is that at greater depths the temperature rises to 34°F approximately, which is the temperature usually found in the deeper parts of the North Atlantic. From 30 fathoms to the surface the temperature changes with the seasons. In the summer the surface temperature rises to 45 or 50°F, and in the winter sinks to 28°F, the freezing point of salt water.

Up to the present no satisfactory explanation has been offered to account for the phenomenon. It seems to me that it can be explained readily by taking account of the influence of iceberg melting. Since the whole Labrador current carries large numbers of icebergs, the effect of these fresh water masses must, in the course of years, be evident in the distribution of temperature and density of the under water. The mean depth of the North Atlantic icebergs is between 30 and 40 fathoms. This is shown from the positions where bergs will ground.

ICEBERG MELTING.

In the first place let me make quite clear what takes place during the melting of a berg. It has been shown by Dr. Otto Pettersson that when ice melts in salt water (Fig. 1) three currents are set up. A horizontal current of sea water sets in towards the ice, which becoming cooled falls by gravity, and constitutes the second current. The third current consists of fresh melted berg water which, being lighter rises and mixes with the surface layers. The result of this process must be to bring about a cooling and drawing down of the surface layer of the sea. Indeed Pettersson has likened an iceberg to a

huge hydraulic pump which continually forces downwards immense quantities of water. In spite of currents and tides which often run faster than the drift of a berg, there must always be a tendency for the berg to cool and sink a large proportion of sea water. The currents must be considered, however, with reference to the density of the sea water layers in which the berg is melting.



Iceberg Melting in Salt Water.

(1) Current of cooled sea water falling. (2) Current of warm sea water flowing towards the berg. (3) Current of sea water diluted by water from melting berg.

Density of the Surface Layers of the Sea.

The Labrador current is of considerably lower salinity than the Gulf Stream. This is shown by the following table which represents conductivity measurements at various parts of the ocean, from Hudson Strait to the mouth of Belle Isle Strait.

TABLE OF CONDUCTIVITY (Temp. 25°C.)

In the Strait of Belle Isle	·04806
Nearly abeam Belle Isle East end	·04865
40 miles east of Belle Isle	·04986
70 " " "	·05047
100 " " "	·05214
200 " " "	·05235
260 " " "	·05257
462 " " "	·05257

Across the polar current east of Belle Isle Strait, the salinity rises steadily until the waters of the Gulf Stream are entered. This lower salinity, which is indicative also of a lower density, must be brought about by the melting of the polar ice and the consequent mixture of the fresh water with the Southern waters. The lower density is observed through Belle Isle Strait and in many parts of the Gulf. Dr. Dawson's density determinations of the Gulf waters are very interesting and show a low surface density which increases regularly with depth, down to about 40 or 50 fathoms. At greater depths the density becomes uniform and practically equal to that of the open Atlantic. These various densities are very important when considering any system of ocean circulation, inasmuch as they show greater differences than are produced by mere change of temperature. It must be that the polar current tends to over-ride the Gulf Stream, in spite of the great difference in temperature between the two currents. This no doubt is responsible for the streaky character of the border of these two currents. It is difficult to see otherwise, why the polar current does not suddenly dip down below the warmer Gulf Stream, leaving a much sharper line of separation along the southern border. Assuming the surface density of the Labrador or polar current to be the same when it meets the Gulf Stream as it is off the mouth of Belle Isle Strait, then comparison of the densities of the two currents shows for

Labrador Current	1·0230
Gulf Stream	1·0257
Difference	·0027

The difference of density of the sea-water due to temperature alone would be, assuming the temperature of the polar current to be 32°F. and that of the Gulf Stream to be 60°F,

$$1{\cdot}02818 - 1{\cdot}02567 = {\cdot}00251$$

a smaller value than that due to difference of salinity alone. It seems to me that these differences in density must considerably modify the

ordinary thermal convection effects, and that in working out any satisfactory theory of ocean circulation, we must fully consider these facts.

Relation of Iceberg Melting to the Stratum of Low Temperature.

Dr. Pettersson has given us some idea of the enormous forces operating in the melting of the polar ice. He says:—

"To melt an ice-field in the northern seas, it is necessary that at least seventeen times its weight in salt water should be cooled and sunk to the bottom. The sinking of this cold water resembles a waterfall more than 1,000 metres in height. Like any waterfall on the earth's surface, this submarine fall can produce work, that is can work the deep currents in the ocean. It is the power of this water-fall that presses up the wall of cold water north of the Iceland-Faroe ridge, as it is the sinking cooled water in the southern ice sea and at Newfoundland that builds up the cold water mountains under the equator and along the coasts of Africa and America. To the question what becomes of all the sinking cooled water? our answer as far as regards the Norwegian and polar sea, is it overflows the rim of the Faroe-Iceland ridge, and sinks to the bottom of the ocean, making a fall of almost ice-cold water 400 or 500 metres below the surface. The question, what becomes of this water in the ocean? must be left to future investigation.

"The sinking of the cooled water whose store of heat has been expended in melting the ice is identical with a water-fall, the effects of which are recognizable in the movement of the bottom layers and submarine currents. The second movement of the ice-melting, i.e., the rising of the melted ice-water to the surface, may also be likened to a water-fall, though in inverse direction, for here the water is lifted from below to the surface. This, too, is a production of labour which is useful in the oceanic circulation, i.e., for working the surface currents of the sea, for instance, the polar current. I have estimated the labour thus produced during the ice-melting in summer between Iceland and Jan Mayen, as equal to the work produced by a water-fall on the earth's surface of about 400,000 h.p. These figures represent the energy which drives the water of the East Iceland polar current towards the Faroes. Incomparably greater is the energy produced by the melting of the Atlantic icebergs in the south polar sea. There the melted ice-water rises from a far greater depth, from the undermost side of icebergs 200 to 500 metres below the surface. As the effect of a water-fall is proportionate to the height from which it falls,

it is easy to estimate that every kilogram of ice melted in this depth will produce an energy equal to 7 kilogrammetres.

"An iceberg floating in the sea contains in itself such a possibility for work. It produces a depression in the surface which would be eliminated the moment the ice was taken away. The surrounding water strives to assume a horizontal surface by eliminating the depression occupied by the ice. The water presses the ice upwards, but as long as the ice forms a solid block, its effects are in vain. The weight of the ice equals the lifting power of the water, which power is localized in the very surface of contact between the ice and the water, but which is unable to produce labour. If heat is brought from outside melting the ice, its molecules will become moveable and lifted up to the surface where the melted ice-water flows out, in the shape of a surface current. This then, is work, by setting free the forces that were tied in the contact surface between the ice and sea-water."

What becomes of the current of cooled sea-water which sinks under the influence of the melting iceberg? This water is drawn from the surface of the sea, where the density is less than at a greater depth. It is cooled, presumably to approximately 30°F. If by this means its density is increased by means of the temperature fall, beyond that of the surrounding sea-water, it will sink. The process of fall must stop, however, by the time the water has reached the lower limit of the cooling agent. At approximately 30 or 40 fathoms, the cooled sea-water finds itself reduced to 30°F. or thereabout, but of less density than the lower layers of sea-water. There will then be no tendency for the water to sink lower, even though the temperature increases a little at greater depths. There will be no agent at work to make this water rise because it gains heat only exceedingly slowly from below, and it is unaffected by the disturbing influence of the waves on the surface. In the course of ages it is conceivable that a cold layer of water produced by the melting of the icebergs, has under-spread the whole polar current, even into the Gulf of St. Lawrence itself. Constantly fed each year by the masses of ice, this cold layer maintains a fairly equal temperature the year round. From Dr. Dawson's measurements, it looks as though a higher temperature existed in the cold stratum early in the spring when the water was coldest, and before the icebergs have begun to melt rapidly. Thus he found in May, 1903, that at 30 fathoms, the temperature off the South East Coast of Newfoundland was from 32 to 35·5°F, whereas on the 11th of August of the same year, the temperature was found to be 31° at the same depth and place. Further measurements are required to establish beyond doubt the connection between iceberg

melting and the layer of low temperature observed by Dr. Dawson. Enough has, however, been said to show that the continual melting of vast quantities of ice must exert some important influence on the temperature and density of the polar current.

Table giving the Specific Gravities of Standard Sea-Water.
t°C = 15·56 = 1026·00. (Dittmar).

t°. C	Density	t°. C.	Density
°		°	
0	1028·18	16	1025·90
1	1028·13	17	1025·67
2	1028·07	18	1025·42
3	1027·99	19	1025·16
4	1027·90	20	1024·90
5	1027·79	21	1024·63
6	1027·68	22	1024·36
7	1027·55	23	1024·08
8	1027·41	24	1023·80
9	1027·26	25	1023·51
10	1027·10	26	1023·21
11	1026·92	27	1022·90
12	1026·74	28	1022·59
13	1026·54	29	1022·27
14	1026·34	30	1021·95
15	1026·13	31	1021·63

Density Determinations of the Gulf of St. Lawrence. (Dawson).

Locality and Date	Surface	50 Fathoms	100 Fathoms	150 Fathoms
At 24 miles N.E. 1/2 N. from Fame Point 12 Sept., 1895..............	1·0222	......	1·0258	1·0262
At 11 miles N.E. by N. from Fame Point 13 Sept. 1895................	1·0220	1·0248	1·0260	1·0261
At 29 miles E. by S. from Cape Gaspé 23rd Sept., 1895..........	1·0234	1·0248	1·00255	1·0259
At 40 miles E.S.E. from Cape Gaspé 23rd Sept., 1895................	1·0238	1·0251	1·0257	1·0258
At 12 miles E.S.E. from St. Paul Island 24th Sept., 1895..........	1·0221	1·0250	1·0257	1·0263
At 30 miles E.S.E. from Cape Egmont 25th Sept., 1895...........	1·0229	1·0251	1·0256	1·0260
Mean densities.............	......	1·0250	1·0257	1·0261

TEMPERATURES AND DENSITIES IN THE DEEP CHANNEL, GULF OF ST. LAWRENCE. (Dawson).

From observations extending over a distance of 200 miles, from Cape Breton to the Gaspé region.

Locality and Date	Surface	50 Fathoms	100 Fathoms	150 Fathoms	200 Fathoms
	°	°	°	°	°
Between St. Paul Island and Cape Ray; at three points 12 miles apart 16th Aug., 1894	58	31·5	37·5	40·5	39·5
	60	33	38·5	40·5	....
	59	....	40	40·5	....
At 13 miles W. by N. from Cape Ray, Aug. 22nd. 1894..........	58	....	39	....	40
At 14 miles W. by N. Cape Ray, 28th Aug., 1894................	....	32·5	40	40·5	39·5
At the centre of Cabot Strait, 30th Aug., 1894....................	63	34	40	40	39·5
On a line along the middle of Cabot Strait at three points 7 miles apart, 27th Sept., 1894.........	53	32·5	37	38	40
	52	32·5	....	40·5	39·5
	52	32·5	39	40·5	39·5
Between Fame Point and Ellis Bay, Anticosti, at three points 6 miles apart 29th June, 1895..........	53	32	36·5	38·5	....
	46	31·5	36·5	38	....
	48	32	37	39·5	....
At 29 miles E. by S. from Cape Gaspé, 23rd Sept., 1895.........	52	32·5	37·5	38·5	....
At 40 miles E.S.E. from Cape Gaspè, 23rd Sept., 1895.........	53	33·5	38·5	40	....
At 12 miles E.S.E. from St. Paul Island, 24th Sept., 1895.........	55	35·5	39	40·5	....
At 30 miles E.S.E. from Cape Egmont, 25th Sept., 1895.......	54	37	39·5	40·5	....
Mean temperatures............	54·4	33·0	38·4	39·8	39·6

Example of Temperature Measurements S.E. of Newfoundland.
(Dawson).

Date	Depth	5 miles out	18 miles	26 miles
May 26, 1903....	Surface	33·5	35·5	36·
	10 F.	32	35	35
	30 F.	32	35	35
Aug. 11th.......	Surface	50	50	50
	5 F.	....	....	50·5
	10 F.	47	42·5	45
	15 F.	....	....	....
	30 F.	32	31·5	31

Deep Temperature, Belle Isle Strait. (Dawson).

Depth	Temperature		
	July 21	July 26	Aug. 4.
Surface............	42·5	46·	50·
5 F..............	41·5	43·	46
10 F..............	33·5	40·5	40
15 F..............	....	37·5	....
20 F..............	30·5	33·5	33
30 F..............	31·0	33·	....

(W. Bell Dawson. Report of Tidal and Current Surveys, 1906 and 1907).

The Nitrogen Compounds in Rain and Snow.

By FRANK T. SHUTT, M.A., F.R.S.C.

(Read May 27, 1914).

This investigation is a Canadian contribution towards an enquiry that has been made in recent years, chiefly in Europe, but which is now also being prosecuted in many other parts of the world, into the amount and character of the nitrogen compounds contained in rain and snow. The chief object in this research, at least from the agricultural point of view, is to ascertain the weight per acre of these compounds which may be furnished to the soil by the precipitation. The extent to which the rain and snow may cleanse and filter the atmosphere is undoubtedly an important factor of hygienic value and there are also other features of scientific interest upon which information may be obtained from the data.

Agriculturally, this investigation is of peculiar interest in throwing some light upon the important and fundamental problem of the upkeep of soil fertility. Recent work in agricultural science has shown that nitrogen is the dominant element of plant food, that, other things being equal, vegetative growth is determined by the stores of available nitrogenous food in the soil. Further, that losses of soil nitrogen occur apart from abstraction through crop growth, through tillage operations and though these may be minimized by due regard to certain procedure, as by the adoption of a rational rotation, which includes the growth of leguminous crops and the periodic laying down to grass, they must nevertheless be taken into consideration in any study of the income and out-go of the soil's nitrogen. There is also an important economic aspect to the question inasmuch as nitroogen, in forms suitable for vegetative assimilation is the most costly of all plant foods, It is obvious, therefore, that any phase of this soil nitrogen problem is of peculiar interest and importance to agriculture.

The combined nitrogen of the atmosphere exists chiefly as ammonia and secondarily as nitrates and nitrites and it is these compounds which have been determined by observers in this research. This source or origin is principally, but not solely, combustion. Undoubtedly the larger proportion arises from the consumption of fuel, and thence the rain in the neighbourhood of large and manufacturing towns is richer than that of the country, but the soil

probably contributes a small quota of ammonia and atmospheric electricity discharges furnish a further small amount of nitrates. In addition to the gaseous compounds, there is also present in the air, in small proportions, organic matter containing nitrogen, due to dust, soot and other small and suspended particles, and this nitrogen as washed out by the rain and snow has been estimated and recorded by the writer as albuminoid ammonia.

This examination, conducted at the Central Experimental Farm, situated just outside the limits of the City of Ottawa, is now in its eighth year and the purpose of this paper, which is practically a report of progress, is to give a summary of the results to the close of the seventh year, February 28th, 1914.

In the following table the precipitation data and the amounts of nitrogen furnished annually per acre for the experimental period are given.

Precipitation and Amount of Nitrogen per acre, Ottawa, Ont., 1908–1914.

	Rain in Inches	Snow in Inches	Total Precipitation in Inches	Pounds of Nitrogen per acre
Year ending February 29, 1908.....	24·05	133·00	37·35	4·322
" " 28, 1909.....	22·99	96·25	32·62	8·364
" " 28, 1910.....	28·79	80·75	36·87	6·869
" " 28, 1911.....	19·67	73·00	26·97	5·271
" " 29, 1912.....	20·33	104·25	30·76	6·100
" " 28, 1913.....	30·34	96·25	39·96	6·144
" " 28, 1914.....	23·31	84·75	31·78	6·208
Average for 23 years..............	25·14	92·03	34·34	
" " 7 years..............	.....	.....	.....	6·182

The average annual precipitation at Ottawa, as calculated for the experimental periods employed in this work, for the past 23 years from the meteorological records of the Farm, is 34·34 inches, 25·14 inches falling as rain and 9·20 (snowfall – 92·03 inches) as snow. In three years of the seven the precipitation has not reached and in four years it has exceeded, the average. The largest variations are to be noted in the year ending February, 1911, with a precipitation of 7·37 inches below the average and in the year closing February, 1913, when the precipitation exceeded the average by 5·62 inches. The variations in the annual snowfalls are, as might be expected, much greater than those of the rainfalls.

With respect to the total nitrogen, as recorded in pounds per acre, the amounts for four of the yearly periods are practically identical, and very close to the average for the seven years, viz., 6·182 lbs.

per acre per annum. The most notable departure is for the year ending February, 1909, when the amount reached 8·364 lbs per acre, an amount which is, undoubtedly, abnormally high. As pointed out in a former communication on the subject to the Royal Society, this exceptional result was due to extensive bush fires which raged for many weeks during the autumn of 1908 in Ontario, Quebec and Northern New York.* The rain falling during this period was very high in free ammonia and, although the precipitation was light, it furnished per acre, approximately, one and a half pounds of nitrogen in September and two and two-tenths pounds in October.

This investigation was begun with the intention of continuing it uninterruptedly for a period of ten years. We shall not, therefore, at this time draw any final conclusion, but it would seem probable from the data obtained that the amount of combined nitrogen furnished by the precipitation in the neighbourhood of Ottawa per acre, per annum, is approximately 6 pounds.

Dr. N. H. J. Miller of the Rothamsted Experiment Station, England, has compiled from all available sources a table giving the nitrogen as ammonia and as nitrates in parts per million and pounds per acre, as determined by various observers in the world.** The results show wide differences, the nitrogen per acre ranging from less than 2 pounds to nearly 20 pounds per annum. However, the larger number of reports indicates considerably less than 10 pounds and very probably the average, where the collections have been made in suburban and rural districts, will not exceed the Ottawa figure. If such be the case, it is obvious that the function of the precipitation in restoring nitrogen to the soil is of no great significance; the nitrogen so supplied would go but a small way towards replacing the losses incurred in irrational farming methods or by the removal of crops. It is, however, worthy of note that this nitrogen is supplied in forms immediately and directly available to plant growth and that the larger amount enriches the soil at a season when vegetation is active. It is therefore a warrantable assumption that the rain apart from its solvent action on the soil and its other important functions directly assists our crops by supplying a portion of the nitrogen required for their growth.

At Ottawa, approximately two-thirds of the total precipitation is as rain. As rain is decidedly and invariably richer than snow in nitrogen compounds, it follows that much the larger proportion of

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*Transactions Royal Society of Canada, Vol. IV, Section III, pages 55–59.

**Composition of Rain water, Journal of the Scottish Meteorological Society, Third Series, Vol. XVI, No. XXX, 1913.

the nitrogen furnished to the soil is from that source; in five years of the seven this proportion has been very close to 85 per cent.

AMOUNTS OF NITROGEN FURNISHED BY RAIN AND SNOW.

	Total	By Rain		By Snow	
		Pounds	Proportion	Pounds	Proportion
	Lbs.		p.c.		p.c.
Year ending February 29, 1908....	4·322	3·243	75	1·080	25*
" " 28, 1909....	8·364	7·528	90**	·836	10
" " 28, 1910....	6·869	5·830	85	1·040	15
" " 28, 1911....	5·271	4·424	84	·847	16
" " 29, 1912....	6·100	5·075	83	1·025	17
" " 28, 1913....	6·144	5·113	83	1·031	17
" " 28, 1914....	6·208	5·192	84	1·016	16

Considering the distribution or proportion of the various nitrogen compounds, it has been found that, of the total nitrogen, approximately 70 per cent is present as free and organic ammonia and 30 per cent as nitrates. This is illustrated by the data for the year 1913–14 given in the following table, which also allows a comparison of the composition of rain and snow. Though as regards the proportions of the several compounds, present in rain and snow, the differences between these two forms of precipitation are not large, the greater richness of rain in all three forms is apparent.

AVERAGE NITROGEN-CONTENT OF RAIN AND SNOW.

(Amount of Nitrogen per Acre as Free and Albuminoid Ammonia and as Nitrates and Nitrites.)

	Number of Samples Analysed	Precipitation in inches	Parts per Million				Percentage of Total			Per Acre	
			In Free Ammonia	In Albuminoid Ammonia	In Nitrates and Nitrites	Total	In Free Ammonia	In Albuminoid Ammonia	In Nitrates and Nitrites	As Free & Albuminoid Ammonia	As Nitrates and Nitrites
Rain..	61	23·31	·327	·145	·328	1·212	61	12	27	3·790	1·402
Snow.	23	84·75	·265	·090	·174	·529	50	17	33	·681	·335

An interesting phase of the subject is the study of the various factors that influence the nitrogen content of the precipitation, and especially that of the rain. Mention has been made of one of the most notable of these—a smoke-laden atmosphere due to bush fires. These

* Snowfall exceptionally heavy.
** Rain abnormally rich in ammonia due to bush fires.

fires have occurred more or less every year during the investigation, usually in the autumn. Naturally they are chiefly in times of great heat and dryness. After a week or so without rain, when such fires prevail, the subsequent rains will be very rich in ammonia and may continue so for a period of several days or even more, unless the precipitation is very heavy.

Another factor is frequency of precipitation, and this is more particularly true during the summer months. A scanty rainfall after a period of hot, dry weather is invariably rich, and on the other hand the later collections after several days of showery weather show a rapidly decreasing nitrogen content.

While the direction of the prevailing winds, during the falling of rain and snow, as for instance toward or from the city, does not apparently markedly influence the nitrogen content, its velocity and violence may, and frequently does, very appreciably affect the character of the rain in this respect. The rain during thunder storms is invariably rich in nitrogen, and this we have attributed chiefly to the presence of an increased amount of dust in the air, though to some extent the nitrates may be increased by the electric discharges (lightning flashes) of the storm. It has been repeatedly noted that the rain falling during or immediately following cyclonic storms of great severity and which "filled" the atmosphere with dust particles, had an exceedingly high nitrogen content, more particularly present as free and albuminoid ammonia.

In this work every precipitation of rain and snow that would yield a sufficiency for analysis from the catchment area has been chemically examined. Early in the investigation it was found that the results from composite samples, representing the rain of a week or a month, were not reliable, and hence that plan, though economical of labour, was not adopted.

The collection of the samples of rain was made on a leaden tray or basin, placed about twenty feet from the ground which for some distance around is lawn and shrubbery. It is approximately 60 x 30 inches. The water as it falls is conducted from the bottom of the basin by means of a glass tube into a glass jar, from which the sample for analysis is taken at the end of each rainfall.

On the Use of the Kelvin-Varley Slide Potentiometer.

BY A. NORMAN SHAW, M.SC.,
Macdonald College, McGill University.

Presented by PROF. H. T. BARNES, F.R.S., F.R.S.C.

Read May 27, 1914.

The Kelvin-Varley Slide has been described in many electrical works,[1] and is well known as a valuable and accurate instrument. It has been found that an exceptional accuracy can be obtained if refined calibrations are occasionally performed. After making several trials of various methods, Prof. Callendar, in connection with his research on "Continuous Electrical Calorimetry",[2] briefly outlined the one which he considered to be the most convenient and accurate. It was thought that a more detailed account and slight extension of the

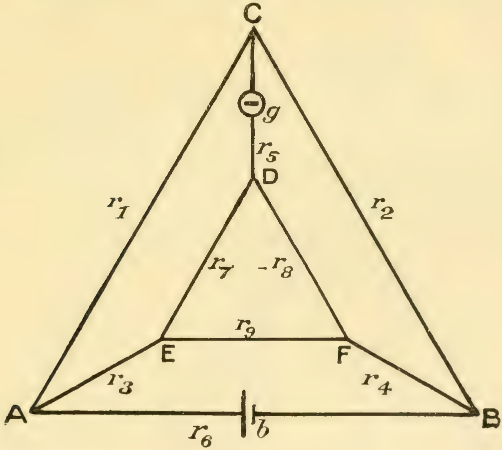

Fig. 1

theory and practice of this calibration would be of service, and these notes are recorded therefore for the purpose of assisting anyone to perform it in a short and simple manner.

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[1] *Price*—"Measurement of Electrical Resistance", p. 106.
Fleming—"Handbook for the Electrical Laboratory and Testing Room", Vol. I., p. 273.
Munro and Jamieson—"Pocket Book of Electrical Rules and Tables", p. 158.
Kempe—"Handbook of Electrical Testing", p. 219.
Aspinall Parr—"Practical Electrical Testing", p. 321. Etc., etc.

[2] Phil. Trans. A., Vol. 199, 1902, p. 65.

It is desirable for reference in explaining subsequent details, to describe, and to explain briefly, the instrument itself. This Slide is devised from a special form of the Double Bridge designed by Kelvin. If nine conductors are placed in the form of a network, one branch containing a galvanometer and another an electromotive force, and arranged as shown in Fig. 1, we have the general form of the Double Bridge.

Let $r_1, r_2, r_3, r_4, r_5, r_6, r_7, r_8, r_9$ be the nine conductors and let the galvanometer g be contained in r_5 and the battery b in r_6. If no current passes through the galvanometer it can easily be shown that

$$\frac{r_1}{r_2} = \frac{r_3 + \dfrac{r_7\, r_9}{r_7 + r_8 + r_9}}{r_4 + \dfrac{r_8\, r_9}{r_7 + r_8 + r_9}} \qquad (1)$$

The Kelvin-Varley Slide consists of an arrangement of this kind in which $r_7 + r_8 = r_9$, and therefore equation (1) reduces to

$$\frac{r_1}{r_2} = \frac{r_3 + \dfrac{r_7}{2}}{r_4 + \dfrac{r_8}{2}} \qquad (2)$$

Figures 2 and 3 show the arrangement of this system in the K.-V. Slides, the latter being an actual diagram. The same letters are used in each of the three figures for the corresponding junctions. It will be apparent how connections can also be made for using the instrument as a potentiometer in the usual way.

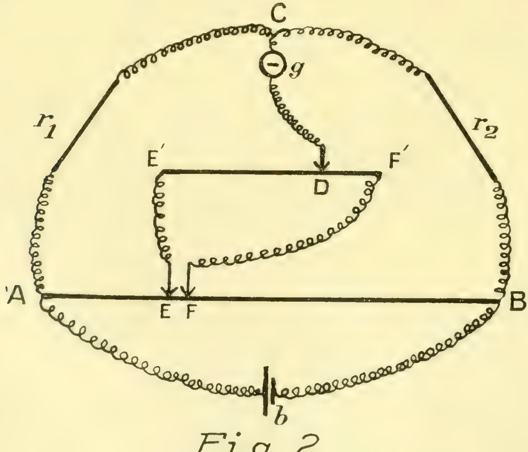


Fig. 2

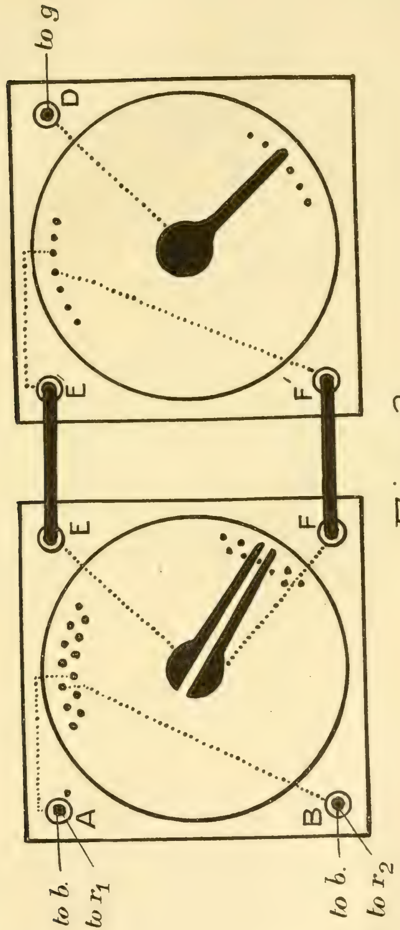


Fig. 3

In the practical form the instrument is composed of two boxes. The main dial AB consists of 101 coils of wire in series, each of 1000 ohms resistance. The ends of each coil are connected to studs tipped with platinum-iridium or with gold, which are set in the top of the box, usually an ebonite slab. A double revolving arm makes contact with a pair of studs including between them two of the 1000 ohm coils. The second or "vernier" dial $E'F'$ connected through negligible resistance to E and F respectively, consists of 100 coils of 20 ohms each, so that the equivalent resistance from A to B is reduced to 100,000 ohms. The ends of each of the 20 ohm coils of the vernier dial are also connected to platinized studs arranged in dial form. A single revolving contact spring can make contact with these one at a time and is connected to the galvanometer terminal.

If n is the reading of the first half of the double contact spring on the main dial and if m is the reading of the vernier spring for a given balance point in an arrangement similar to that shown in the diagram, then we have from equation (2), that,

$$\frac{r_1}{r_2} = \frac{1000n + 10m}{100{,}000 - 1000n - 10m} \tag{3}$$

If the instrument is used as a potentiometer, then $1000n+10m$ corresponds to the usual potentiometer reading.

The same slide as that discussed by Prof. Callendar was used by the writer. The corrections, however, which he determined in 1894, were found to have changed by varying amounts. It has been found that the continual slow change in the resistance of any of the coils measured relatively to the rest of the coils, may amount to several parts in a hundred thousand within a few months. The ratio of the two halves of the box should be frequently tested in order to give warning of any accidental flaw. This is not, however, a sufficient test

for determining whether a recalibration is necessary or not, because the ratio of the two halves of the box can remain fairly constant while the ratio of a smaller number of the coils to the remainder alters appreciably. An examination of the tables given later will show that this was actually the case with our instrument. The following is the method for testing the two halves of the slide.

A box of 100,000 ohms is arranged in parallel with the main slide box, between the terminals A and B. A battery is connected between the same terminals and a high resistance galvanometer is connected between the galvanometer terminal on the vernier box and the middle of the extra 100,000 ohms. The main slider is then placed at 50, and the vernier at zero. We now have an ordinary Wheatstone's bridge. If we call the first fifty coils A and the last fifty B, and if we let the two halves of the 100,000 ohm box be represented by C and D respectively, then we would obviously have $\frac{C}{D} = \frac{A}{B}$ if there were a perfect balance; but if the four arms differ slightly among themselves there will be a small deflection in the galvanometer. Calling this deflection d, we have then

$$\frac{C}{D} = \frac{A}{B} + kd \tag{4}$$

where k is a constant depending on the galvanometer and scale. The vernier slider is now placed at the first coil and we get a new deflection d'. We have now, therefore,

$$\frac{C}{D} = \frac{A+10}{B-10} + kd' \tag{5}$$

The vernier slider is replaced at zero and A and B are interchanged with respect to the rest of the circuit, giving another deflection d''. Hence we also have

$$\frac{C}{D} = \frac{B}{A} + kd'' \tag{6}$$

In practice it is advantageous to obtain the d's by reversing the current through the galvanometer. Assuming that A and B each differ from 50,000 by quantities relatively very small, and eliminating C, D and k from these equations we find that

$$\frac{A}{B} = 1 - .000200\,\frac{d-d''}{d-d'} \tag{7}$$

If a high resistance galvanometer is used this measurement can be made with great accuracy, and this ratio should not vary more than one or two parts in a hundred thousand, during several years. From the year 1894 to the year 1899 this ratio for our instrument fluctuated up and down between .999832 and .999863. In January, 1911, it was .999858.

One of the simplest ways to find out if a recalibration is necessary is to measure resistances in several such ratios as 1 to 10, 1 to 8, 1 to 6, 1 to 4, and 1 to 2, then to interchange the terminal connections and repeat the observations. If after applying the corrections determined by the last calibration it is found that there are discrepancies between the two sets of observations, then it is evident that the slide needs recalibrating. If the magnitude of the discrepancy appears to vary systematically with the magnitude of the ratios compared, it is probable that some particular coil is responsible for the whole trouble. These can easily be singled out, and a complete recalibration becomes unnecessary.

Theory of the Calibration.

The method finally adopted by Prof. Callendar for the calibration consists in determining the relative values of the coils of the main dial in pairs by comparison with the 2000 ohms of the vernier dial. The connection between F and F' is disconnected and replaced by a pair of 2000 ohm coils in series which form ratio arms. A battery is connected to the point between the two 2000 ohm coils and the terminal E; and a galvanometer is placed in parallel with the ratio arms P and Q, thus forming a Wheatstone's Bridge for comparing the vernier dial V with any pair of consecutive coils. Readings may now be taken with the slider at any reading and if we designate the 101 coils by R_1, R_2, R_3, ... R_{101}, we can get a hundred equations of the same type as (4), viz.

$$\left.\begin{aligned} R_1 + R_2 &= V\frac{P}{Q} + kd_0 \\ R_2 + R_3 &= V\frac{P}{Q} + kd_1 \\ \cdots & \quad\quad \cdots \\ \cdots & \quad\quad \cdots \\ R_{100} + R_{101} &= V\frac{P}{Q} + kd_{100} \end{aligned}\right\} \qquad (8)$$

where $d_0, d_1, \ldots d_{100}$ are the deflections on the galvanometer corresponding to the readings 0, 1....100 on the slider, and k is a constant which can at once be obtained by changing P or Q by one ohm. It is necessary to know one more equation, and using two one thousand ohm coils in series between the terminals E, F and following the same plan as that used for the determination of the ratio of the two halves of the main box we can at once get equations of the types (4) and (6) and by altering one of the thousand ohm coils by one ohm we can obtain an equation corresponding to (5) and from these we get

$$\frac{R_2}{R_1} = 1 + b \qquad (9)$$

where b represents the small known quantity.

By substitution in equations (8) we obtain

$$\left.\begin{aligned}
R_1 &= \tfrac{1}{2}V\frac{P}{Q} + \left[k\left(\frac{d_0}{2+b}\right) - \frac{b}{4}V\frac{P}{Q}\right] = \tfrac{1}{2}V\frac{P}{Q} + a_1 \\
R_2 &= \tfrac{1}{2}V\frac{P}{Q} + \left[k\left(d_0 - \frac{d_0}{2+b}\right) + \frac{b}{4}V\frac{P}{Q}\right] = \tfrac{1}{2}V\frac{P}{Q} + a_2 \\
R_3 &= \tfrac{1}{2}V\frac{P}{Q} + \left[k\left(d_1 - d_0 + \frac{d_0}{2+b}\right) - \frac{b}{4}V\frac{P}{Q}\right] = \tfrac{1}{2}V\frac{P}{Q} + a_3 \\
&\cdots \qquad \cdots \qquad \cdots \\
&\cdots \qquad \cdots \qquad \cdots \\
&\cdots \qquad \cdots \qquad \cdots \\
&\cdots \qquad \cdots \qquad \cdots \\
&\cdots \qquad \cdots \qquad \cdots \\
R_{101} &= \tfrac{1}{2}V\frac{P}{Q} + \left[k\left(d_{99} - d_{98} + \ldots + \frac{d_0}{2+b}\right) - \frac{b}{4}V\frac{P}{Q}\right] = \tfrac{1}{2}V\frac{P}{Q} + a_{101}
\end{aligned}\right\} \quad (10)$$

where a_1, a_2, a_3, etc., can be calculated at once from b, k and d since we may substitute $500b$ for $\frac{b}{4}V\frac{P}{Q}$. As an aid to the numerical work it is useful to note that

$$a_n = kd_{n-2} - a_{n-1} \qquad (11)$$

Let us assume, temporarily, that $\sum_1^{101} R_n$ is equal to 101,000 ohms exactly, where $\sum_1^{n} R_n$ represents summation of the resistances from 1 to n inclusively. By addition of equations (10) we obtain

$$101000 = \frac{101}{2}V\frac{P}{Q} + \sum_1^{101} a_n \qquad (12)$$

hence

$$\left.\begin{aligned}
R_1 &= 1000 + a_1 - \frac{\sum_1^{101} a_n}{101} \\
R_2 &= 1000 + a_2 - \frac{\sum_1^{101} a_n}{101} \\
&\text{etc.}
\end{aligned}\right\} \qquad (13)$$

and

$$\sum_1^{n} R_n = 1000\,n + \sum_1^{n} a_n - \frac{n\sum_1^{101} a_n}{101} \qquad (14)$$

that is to say, the total correction for a reading n is $\sum_1^{n} a_n - \dfrac{n\sum_1^{101} a_n}{101}$.

This does not however take into account the fact that two of the coils are always shunted by the vernier in actual use. A further correction is thus introduced into the correction for the main slider. In a manner similar to that employed before, we may obtain

$$\frac{R_1 + R_2}{V} = 1 + c \tag{15}$$

where c is the known small quantity, but we know that

$$R_1 + R_2 = 2000 + a_1 + a_2 - \frac{2 \sum_1^{101} a_n}{101}$$

mean slider ohms, hence

$$V = 2000 + \left(a_1 + a_2 - \frac{2 \sum_1^{101} a_n}{101} - 2000\,c\right)$$

$$= 2000 + e \tag{16}$$

mean slider ohms, where e represents the known part. When the slider reading is n the coils shunted are R_{n+1} and R_{n+2}. The equivalent resistance, therefore, in terms of the mean slider ohm is,

$$1000 + \tfrac{1}{4}\left(a_{n+1} + a_{n+2} - 2\,\frac{\sum_1^{101} a_n}{101} + e\right) \tag{17}$$

For any reading n of the slider we require for our calibration to find the correction to be added to n to give the true ratio of the first n coils to the whole resistance of the slide, the coils R_{n+1} and R_{n+2} being shunted by the vernier. When shunted the total resistance in terms of mean slider ohms is not 100,000 but

$$101000 - R_{n+1} - R_{n+2} + 1000 + \tfrac{1}{4}\left(a_{n+1} + a_{n+2} - \frac{2 \sum_1^{101} a_n}{101} + e\right)$$

which equals

$$100000 + \tfrac{1}{4}e - \tfrac{3}{4}\left(a_{n+1} + a_{n+2} - 2\,\frac{\sum_1^{101} a_n}{101}\right) \tag{18}$$

$\tfrac{1}{4}e - \tfrac{3}{4}\left(a_{n+1} + a_{n+2} - 2\,\frac{\sum_1^{101} a_n}{101}\right)$ is thus the correction due to the shunting when the slide is at n — call this correction v_n.

Now, in most cases it is desirable to express a reading in terms of the whole box as 100,000 ohms. Equation (14) gives us the corrections when the vernier is absent and the total resistance is assumed to be 101,000 ohms. In order to express the reading in terms of the slider as 100,000 ohms when any two coils are shunted, we must

multiply the right-hand side of equation (14) by $\frac{100000}{100000+v_n}$. Hence the true reading for the slider at n is given by

$$\sum_1^n R_n = 1000n + \sum_1^n a_n - \frac{n \sum_1^{101} a_n}{101} - \frac{n}{100} v_n \tag{19}$$

There may also be small errors in the vernier coils, but these may generally be neglected because they form such a small fraction of the whole reading. Such errors only become important when the slide reading is at or near zero in connection with the measurement of the ratio of a very small resistance or electromotive force, to a large one. Except for these special cases nothing can be gained by a calibration of the vernier coils. The correction to be applied to the vernier if the reading on it is m, would be

$$\sum_1^m r_m + \frac{m}{400}\left(a_{n+1} + a_{n+2} - \frac{2 \sum_1^{101} a_n}{101} + e\right) \tag{20}$$

where $\sum_m^1 r_m$ is the sum of the errors of the vernier coils up to m expressed in mean ohms of the vernier and $\frac{1}{4}\left(a_{n+1} + a_{n+2} - \frac{2 \sum_1^{101} a_n}{101} + e\right)$ is the difference from 1000 ohms of the vernier coils shunted by R_{n+1} and R_{n+2} of the main slide, as derived in equation (17). It will be seen that if n is very small the second term in the above expression (20) may become very important and the first term quite appreciable if m is large.

Practical Details of the Calibration.

The actual procedure and the subsequent calculations may be performed quite simply. In order to illustrate the method fully, and to show the magnitude of the measurements and corrections an account is given below of the calibration of the Kelvin-Varley Slide at McGill University.

The best kind of galvanometer at our disposal for this work was found to be a four coil Thomson reflecting galvanometer of the usual type with the coils in parallel giving a resistance of 1500 ohms. The value of $\frac{R_1+R_2}{V}$ was determined first and repeated subsequently during and after the main observations. The circuit is connected as described above in preparation for obtaining the equations (8). By altering one of the two thousand ohm coils by one ohm and also by

interchanging R_1+R_2 and V with regard to the rest of the circuit we get, in the same way as we obtained equations (4), (5) and (6), the three equations

$$\left.\begin{aligned}\frac{P}{Q} &= \frac{R_1+R_2}{V} + Kd\\ \frac{P+1}{Q} &= \frac{R_1+R_2}{V} + Kd'\\ \frac{P}{Q} &= \frac{V}{R_1+R_2} + Kd''\end{aligned}\right\} \tag{21}$$

which gives us $\left(\text{since we may take } \frac{1}{Q} = \frac{1}{2000}\right)$

$$\frac{R_1+R_2}{V} = 1 + \frac{d-d''}{4000\,(d-d')} \tag{22}$$

The deflections were always obtained by reversing the current through the galvanometer. In one case the deflections, expressed in scale divisions, were

$$d = +139,\ d' = -129 \text{ and } d'' = +26,$$

This gives $\frac{R_1+R_2}{V} = 1.00011$. The following is a list of values obtained for this ratio, before, during and after our calibration.

	1.00014
	1.00012
	1.00008
	1.00010
	1.00011
	1.00015
	1.00014
	1.00010
	1.00008
	1.00010
Mean	1.00011

It will be seen that such variations from the mean value 1.00011 can be neglected in the calculation of the complete corrections.

The determination of $\frac{R_2}{R_1}$ is made in a similar manner, but in this case two one-thousand ohm coils are used for the auxiliary arms and it is necessary to make one of the galvanometer contacts by means of a copper wire to the stud between coil 1 and coil 2, the glass cover of the main slide being removed for the purpose of this test. Performing the same operations as before we get the three analogous equations reducing to

$$\frac{R_2}{R_1} = 1 + \frac{d-d''}{2000\,(d-d')} \tag{23}$$

One set of values obtained were $d = +168$, $d' = +351$ and $d'' = -246$ and hence $\frac{R_2}{R_1} = .99887$. Repetitions of this measurement, taken at different times during three months, showed the following constancy:

	.99885
	.99887
	.99888
	.99887
	.99890
	.99885
	.99887
Mean	.99887

The small variations in this case are almost entirely due to the contact resistance between the stud and the revolving contact maker. It is very necessary to note that the spring is making proper contact all round before using the instrument for accurate work. This is easily ascertained by applying slight pressure on the contact springs when the instrument is connected in the circuit for taking the main observations. If there is any appreciable change it will at once be shown by the galvanometer, but this error can be eliminated by carefully polishing the tips of the studs with chamois and by slightly tightening the spring. A variation as large as two parts in 10,000 has been found, which was entirely due to this cause.

The constant k must be determined from time to time during the calibration in order to note any slight unequal temperature changes in the circuit. This is rapidly done by obtaining a balance and then changing P by one ohm, k being given by the reciprocal of the difference of the two deflections.

The successive observations of the hundred deflections for equations (8) are taken as indicated above, but in the course of observation a slight further error is introduced. A small current must necessarily be flowing through the vernier coils and the auxiliary arms continuously while the successive coils of the main slide only receive it temporarily. With the application of two volts, it was found that there was sufficient heating effect to alter appreciably the effective value of $V\frac{P}{Q}$ during the calibration. A simple method of correcting for this error can be obtained in such a manner as the following. The first ten readings are taken and then the first one is repeated. Any slight change can readily be applied as a correction to reduce all subsequent readings to those that would have been obtained with $V\frac{P}{Q}$ under the initial conditions. This would again be checked at 20, 30, 40, etc., and the extra corrections would accumulate as the calibration proceeded. The choice of the gap between the repetition observations can be greater or less than ten according to the magnitude of the

temperature variation obtained. It depends upon the speed of calibration and the type of auxiliary circuit used. This temperature correction reached as high as 0.11 ohms in one case. In the table given below, these corrections have already been applied.

After the successive deflections have been obtained, and corrected for this temperature effect, it is possible to reduce the calculation of the final corrections to a very simple arithmetical process. Table I which is explained in detail below, illustrates this method, and Table II gives a list of the corrections obtained in our case. α_n is employed to represent $a_n - \dfrac{\sum_1^{101} a_n}{101}$ in what follows.

In Table I, n represents the slider reading. d_n is the deflection obtained for the reading n. k varied from $\frac{1}{268}$ to $\frac{1}{273}$ during the calibration, and kd_n represents the difference of the value of $R_{n+1} + R_{n+2}$ from that of $V\frac{P}{Q}$. For a_1 we have $a_1 = \frac{kd_0}{2+b} - 500b = \frac{.52}{2.001} + .56 = .82$ in the case of this calibration. The remaining values of a_n can then be obtained from the preceding column by means of the equation $a_n = kd_n - a_{n-1}$. α_n is given by subtracting the value of $\left(\dfrac{\sum_1^{101} a_n}{101}\right)$ from a_n. $\dfrac{\sum_1^{101} a_n}{101}$ is obviously the algebraic sum of the column for a_n divided by 101, and in the above case this amounted to $-.12$. The figures of the next column are merely the additions up to n of the preceding values. It will be noted that this forms the chief part of the correction and for many purposes would give a sufficiently accurate calibration. The values for $\alpha_{n+1} + \alpha_{n+2}$ can be computed immediately from the column for α_n. Now $v_n = \frac{e}{4} - \frac{3}{4}(\alpha_{n+1} + \alpha_{n+2})$ and in order to make it possible to calculate the figures more rapidly the next column is introduced in which $\frac{e}{4}$ is added in each case to $\frac{1}{4}$ of the corresponding value in the column for $\alpha_{n+1} + \alpha_{n+2}$

$$(e = \alpha_1 + \alpha_2 - 2000c = .54).$$

To get v_n it is then only necessary to subtract the values in this last column from the corresponding values in the preceding one. Finally to obtain the total correction, it is necessary to add $\frac{n}{100} v_n$ to $1000n + \sum_1^n \alpha_n$.

A comparison of the figures given in Table II with those obtained by Prof. Callendar (loc. cit.) for the same instrument in 1894 shows

that a calibration of this kind must be repeated from time to time in order to maintain the degree of accuracy in the use of the instrument. The slow alterations in the coils can attain considerable magnitude and ultimately render old calibrations quite useless. The changes are due, usually, to an average effect rather than to especial weakness in some particular coil or coils. It is thus possible to get a good indication of the condition of the whole box by taking and comparing readings for several ratios measured first from one end of the slide and then from the other. At the same time it is at once apparent in such a test, if the variation happens to be a purely local one. For measurements requiring an accuracy of more than one part in ten thousand we should not rely upon a calibration which is older than a year.

TABLE I.

	First set taken on Mar. 13, 1911, at 21.2°C.		Second set taken on Mar. 31, 1911, at 22.1°C.		Values based on the mean of the two sets.							
n	d_n	kd_n	d_n	kd_n	Mean kd_n	a_n	α_n	$\sum_1^n \alpha_n$	$\alpha_{n+1} + \alpha_{n+2}$	$\frac{e}{4} + \frac{1}{4}(\alpha_{n+1} + \alpha_{n+2})$	v_n	$\sum_1^n R_n$
0	+140	+ .52	+139	+ .52	+ .52	....	....	....	+ .76	+ .32	− .44	0.00
1	−192	− .72	−195	− .73	− .72	+ .82	+ .94	+ .94	− .48	+ .01	+ .49	1000.94
2	−293	−1.05	−298	−1.11	−1.08	− .30	− .18	+ .76	− .84	− .08	+ .76	2000.74
3	−100	− .37	−105	− .39	− .38	− .42	− .30	+ .46	− .14	+ .10	+ .24	3000.45
4	+ 61	+ .23	+ 61	+ .23	+ .23	− .66	− .54	− .08	+ .48	+ .26	− .22	3999.93
5	− 99	− .37	− 92	− .34	− .36	+ .28	+ .40	+ .32	− .10	+ .11	+ .21	5000.31
6	+146	+ .55	+144	+ .54	+ .54	− .05	+ .08	+ .40	+ .80	+ .33	− .47	6000.43
7	+234	+ .87	+214	+ .80	+ .84	− .31	− .18	+ .22	+1.10	+ .41	− .69	7000.27
8	− 71	− .26	− 82	− .31	− .28	+ .85	+ .98	+1.20	− .02	+ .13	+ .15	8001.19
9	−145	− .54	−147	− .55	− .54	− .01	+ .12	+1.32	− .28	+ .06	+ .34	9001.29
10	− 87	− .32	− 93	− .35	− .34	− .27	− .14	+1.18	− .08	+ .12	+ .20	10001.16
30	− 53	− .20	− 59	− .22	− .21	−1.14	−1.02	− .98	+ .04	+ .14	+ .10	29998.99
50	−285	−1.06	−287	−1.07	−1.06	− .77	− .64	−3.18	− .80	− .06	+ .74	49996.48
70	+ 5	+ .02	+ 0	+ .00	+ .01	+ .66	+ .78	−2.18	+ .26	+ .20	− .06	69997.86
90	+240	+ .90	+239	+ .89	+ .90	− .38	− .26	+ .10	+1.14	+ .42	− .72	90000.75
98	−166	− .62	−166	− .62	− .62	− .37	− .24	+ .54	− .36	+ .05	+ .41	98000.14
99	−188	− .70	−187	− .70	− .70	− .23	− .10	+ .44	− .44	+ .02	+ .46	98999.98
100						− .39	− .26	+ .18				
101						− .31	− .18	+ .00				

TABLE II.

n	Corrections.	n	Corrections.	n	Corrections.
0	+ .00	34	−1.63	68	−2.57
1	+ .94	35	−2.12	69	−2.74
2	+ .74	36	−1.72	70	−2.14
3	+ .45	37	−2.33	71	−2.47
4	− .07	38	−2.26	72	−2.16
5	+ .31	39	−2.66	73	−2.02
6	+ .43	40	−2.65	74	−1.78
7	+ .27	41	−2.42	75	−1.04
8	+1.19	42	−1.99	76	− .39
9	+1.29	43	−2.15	77	− .16
10	+1.16	44	−1.46	78	+ .46
11	+1.00	45	−2.16	79	+ .32
12	+1.20	46	−2.02	80	+ .75
13	+ .88	47	−2.64	81	+ .93
14	+2.33	48	−2.65	82	+1.00
15	+1.97	49	−2.98	83	+ .75
16	+1.87	50	−3.55	84	+ .54
17	+1.65	51	−4.02	85	− .14
18	+1.44	52	−4.06	86	− .23
19	+1.15	53	−4.69	87	− .01
20	+1.19	54	−4.33	88	− .18
21	+ .89	55	−4.74	89	+ .34
22	+1.33	56	−4.93	90	+ .75
23	+1.31	57	−4.84	91	+ .56
24	+1.43	58	−4.69	92	+ .32
25	+ .74	59	−4.70	93	+ .78
26	+ .51	60	−3.81	94	+1.02
27	− .04	61	−4.15	95	+ .70
28	+ .07	62	−3.28	96	+ .54
29	− .27	63	−3.34	97	+ .40
30	− .11	64	−2.85	98	+ .14
31	−1.27	65	−2.70	99	− .02
32	−1.14	66	−2.83		
33	−1.59	67	−2.92		

On the Diurnal Changes in Magnetic Declination at Agincourt,
1902–1912.

By W. E. W. JACKSON, M.A.

Presented by R. F. Stupart, F.R.S.C.

(Read May 27, 1914).

The changes which take place in the direction of the Earth's magnetic field at any one station must be thoroughly known before we can say definitely what direction a magnet, if suspended freely, will take with reference to a meridian. Before the establishment of fixed observatories it was known that there were certain times of the day when the needle would point in a different direction to other times, but as the angular values were small and of little moment for mariner's purposes, no thorough study was made of them. In the early part of the 19th century it was noted by different philosophers, amongst whom was von Humboldt, that the diurnal range was not always of the same amount, that it varied from place to place, and also with the season of the year.

At the request of the Royal Society and the British Association, due to von Humboldts efforts, several observatories were authorized by the British Government to be established in different parts of the British possessions for the investigation of the changes taking place in the Earth's magnetism, and one of these was established at Toronto in 1839, where it was kept in operation until 1897 when, on account of electric disturbance from the trolley system, it became necessary to move to the present quarters at Agincourt, some 12 miles distant.

Since 1880 photographic records of the changes in the Earth's magnetic forces have been obtained, whilst prior to that time the records were all from actual eye observation.

It is proposed to present in this paper some of the results obtained from an analysis of the curves secured at Agincourt during the eleven year period 1902 to 1912.

Measurements have been made from the curves at every hour of the 24 for all days, and these hourly values have been combined for each calendar month, and taking in succession the difference of each hourly value from the arithmetic mean for the month, we obtain what is known as the diurnal inequality. The smooth pro-

gression so obtained in the hourly means from a large number of days is seen in but very few if any of the individual days.

In Table I is given the diurnal inequality of Declination at Agincourt for each month of the year derived from all days of the eleven years 1902 to 1912. Distinct maxima and minima are in heavy type and the last line gives the ranges as derived from the hourly values.

TABLE I.—DIURNAL INEQUALITY OF DECLINATION AT AGINCOURT—ALL DAYS, 1902-1912.

Hour	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1........	−0·17	−0·52	−0·95	−1·00	−0·71	−0·29	−0·74	−0·55	−0·52	−0·46	−0·12	−0·32
2........	**+0·05**	−0·31	−0·82	**−0·78**	−0·71	**+0·01**	**+0·16**	**+0·33**	−0·35	**−0·26**	**+0·37**	+0·19
3........	−0·25	**−0·26**	**−0·59**	−1·28	**−0·57**	−0·36	+0·07	−0·37	−1·18	−0·63	−0·00	**+0·19**
4........	−0·31	−0·41	−0·83	−1·12	−0·94	−0·70	−0·41	−0·61	−1·95	−0·85	−0·47	−0·25
5........	−0·30	−0·64	−1·00	−1·69	−2·33	−1·99	−1·74	−1·72	−1·73	−0·90	−0·91	−0·64
6........	−0·48	−1·06	−1·23	−2·42	−3·88	−3·78	−3·71	−3·79	−2·92	−0·87	−1·34	−0·76
7........	−0·63	−0·87	−2·29	−3·42	−4·59	−5·21	−5·32	−5·57	−4·52	−1·96	−1·37	−0·89
8........	−1·44	−1·71	−3·60	**−4·26**	**−4·84**	**−5·49**	**−5·78**	**−6·20**	**−4·63**	−2·75	−2·02	−1·35
9........	**−2·58**	**−2·50**	**−3·73**	−3·94	−3·69	−4·30	−4·82	−4·84	−3·17	**−3·02**	**−2·37**	**−1·97**
10........	−2·31	−1·90	−2·61	−1·97	−1·11	−1·81	−2·21	−1·21	−0·33	−1·36	−1·12	−1·26
11........	−0·11	−0·30	0·00	+1·05	+2·31	+1·47	+1·21	+2·88	+3·08	+0·95	+0·96	+0·46
Noon	+1·79	+1·78	+3·04	+3·98	+4·77	+4·25	+4·21	+5·90	+5·76	+3·49	+3·04	+2·33
13........	+2·98	+3·07	+4·63	+5·49	**+5·60**	**+5·44**	+5·62	**+6·93**	**+6·22**	**+4·49**	**+3·79**	**+3·28**
14........	**+3·27**	**+3·57**	**+5·03**	**+5·83**	+5·48	+5·36	**+5·73**	+6·56	+5·43	+4·20	+3·51	+3·09
15........	+2·81	+3·12	+4·36	+4·87	+4·52	+4·60	+4·82	+4·71	+3·47	+3·26	+2·42	+2·31
16........	+2·05	+2·38	+3·11	+3·52	+2·91	+3·23	+3·51	+2·81	+1·56	+1·99	+1·47	+1·62
17........	+0·94	+1·33	+1·66	+1·90	+1·36	+1·61	+1·74	+1·09	+0·21	+0·96	+0·70	+0·71
18........	+0·35	+0·45	+0·85	+0·42	+0·15	+0·53	+0·60	−0·10	−0·35	+0·48	+0·05	+0·11
19........	−0·36	+0·05	+0·13	−0·25	−0·24	−0·02	−0·21	−0·70	−0·49	−0·45	−0·72	−0·72
20........	−0·82	—0·74	−0·47	−0·46	−0·42	−0·24	−0·20	−0·75	−0·66	−1·28	−1·13	−1·21
21........	−1·23	**−1·49**	−1·14	−1·02	−0·72	−0·71	−0·45	−1·25	**−1·29**	**−1·70**	−1·50	**−1·72**
22........	**−1·58**	−1·30	**−1·36**	**−1·40**	−0·66	−0·55	−0·68	**−1·40**	−0·94	−1·28	**−1·61**	−1·21
23........	−1·01	−0·97	−1·14	−1·09	**−1·01**	**−0·78**	**−0·83**	−1·34	−0·48	−1·11	−1·09	−1·15
24........	−0·66	−0·68	−1·05	−0·98	−0·70	−0·40	−0·67	−0·71	**−0·07**	−0·88	−0·64	−0·56
Range.....	5·85	6·07	8·76	10·09	10·44	10·93	11·51	13·13	10·85	7·51	6·16	5·25

The monthly diurnal curves are exhibited graphically in Plate 1, where the distinctive characteristics of the different seasons of the year can be readily seen. The extent to which the type of the curves vary with the season can better be grasped by taking the inequality for March and drawing it to scale, and then represent December and June on scales so related that the mean length of the 24 hour ordinates is the same as for March. This is shewn in Plate II. It will be seen that the difference in type is mainly confined to the hours between 6 p.m. and 9 a.m. when the differences from the mean are the least and the changes less rapid.

If now we analyze these diurnal inequalities as given in Table I by means of Fourier series it is found that a close degree of accuracy is attained from the first four terms having periods of 24, 12, 8 and 6 hours respectively, an accuracy which is less than the probable error of observation of the magnetic elements. It must not be assumed, however, that distinct natural forces are in operation, which may be assigned to these different Fourier waves, although if such forces did exist it would add greatly to the usefulness of this method of

analysis, owing to the facility with which we could study the variations of the forces throughout the year.

The absence of any natural force, nevertheless, does not impair the usefulness of Fourier series, for by it if we are comparing inequalities from different stations or for different seasons of the year, or for different years we are enabled to indicate the nature of the differences which exist in a more precise manner than otherwise.

The Fourier analysis may be expressed in either of the equivalent forms:

$$a_1 \cos t + b_2 \sin t + a_2 \cos 2t + b_2 \sin 2t + \ldots.$$

$$c_1 \sin (\alpha_1 + t) + c_2 \sin (\alpha_2 + 2t) + \ldots\ldots$$

where a_1, b_1, c_1 and α_1, etc., are known as Fourier coefficients, and where t represents the time counted from midnight at the rate of 15° to the hour. The a, b constants are calculated directly from the 24 hourly values in the diurnal inequality and the c (amplitude) and α (phase angle) coefficients are then deduced by means of the formulæ.

$$\alpha_n = \tan^{-1} (a_n/b_n)$$

$$c_n = \sqrt{a_n^2 + b_n^2}$$

where n = 1, 2, 3, &c.

An increased value of a phase angle means an earlier occurrence of a maxima or minima of the term involved. The method of determining these times is best shewn by an example. First, suppose the 24 hour term to be $1'.26 \sin (226° + t)$. Since a sine has its maximum at 90°, 450°, &c., we put

$$226° + t = 450°$$

$$\therefore \quad t = 214°$$

allowing 15° to the hour we have

$$t = 214° = 14.3 \text{ hours or 2h. 18m. p.m.}$$

The minimum occurs of course 12 hours earlier or at 2 h. 18m. a.m. The term fluctuates between + 1'.26 and − 1'.26, its so-called amplitude being 1'.26, but its range is double this or 2'.52.

As a second example suppose the 12 hour term to be $1'.51 \sin (18° + 2t)$. The first maximum is given by putting

$$18° + 2t = 90°$$

whence t = 36 = 2hr. 24m.

Therefore the first maximum (+1'.59) occurs at 2h. 24m. a.m. and a second equal maximum at 2h. 24m. p.m. The two minima (each −1'.59) occur of course midway between the maxima or at 8h. 24m. a.m. and 8h. 24m. p.m.

In Table II are given the amplitudes and phase angles of the twenty-four, twelve, eight and six hour terms of the diurnal inequalities

of D at Agincourt (1902–1912). 75th meridian time has been employed and all days were taken in forming the Diurnal inequalities.

TABLE II.

FOURIER COEFFICIENTS FOR DIURNAL INEQUALITIES OF D AT AGINCOURT 1902–1912. 75th M.T.

	C_1	C_2	C_3	C_4	a_1	a_2	a_3	a_4
	′	′	′	′	°	°	°	°
January........	1·26	1·59	0·58	0·51	226	9	194	41
February......	1·53	1·60	0·52	0·37	222	10	191	33
March..........	2·31	2·16	0·97	0·43	217	15	212	50
April...........	2·87	2·50	1·04	0·24	218	29	218	54
May...........	2·96	2·68	1·06	0·12	216	42	248	126
June...........	2·90	2·86	1·05	0·15	207	36	249	117
July............	2·96	3·00	1·23	0·12	206	32	245	145
August.........	3·07	3·45	1·51	0·32	219	40	253	96
September.....	2·70	2·76	1·18	0·54	225	53	248	82
October.........	1·92	1·80	0·73	0·54	229	29	222	65
November.....	1·47	1·76	0·50	0·44	235	29	237	44
December......	1·25	1·54	0·32	0·37	239	21	225	41
Means..........	2·27	2·31	0·89	0·35				

In regard to amplitudes we see that the first three terms have their maximum at midsummer and their minimum in midwinter, whilst the 6 hour term has its maximum at the equinoxes and its minimum at midsummer. An examination of the phase angles shows that in the 24 hour term the occurrence of maximum is earlier in midwinter than midsummer by 33° or 2h. 12m. and that the change is gradual from the one season to the other. The phase angle of the 12 hour term has its maximum earlier in the summer by about 21° or 42 minutes, but the time of earliest occurrence is not so well marked, the September value in this group of years being the larger. In the 8 hour term the phase angle also shows its earliest occurrence of maximum in the summer, being 62° or 1 h. 24m. earlier than in the winter, but the progression from one season to the other is not quite so uniform in the 12 hour and 8 hour terms as in the 24 hour term. The 6 hour term is still less regular in the progression from season to season, but the earliest occurrence is again in the summer, being 112° or 1h. 52m. earlier than in the winter.

These results are better seen perhaps by grouping the diurnal inequalities for the various months into the seasons, taking for winter the months January, February, November and December, and for Equinox the months March, April, September and October, and for Summer May, June, July and August.

The amplitudes and phase angles are given in Table III for the different seasons and for the year, and along with them are given those for Kew for the period 1890–1900, which, while not strictly comparable, being for a group of years whose sun spot frequency according to Wôlfer is 41·7[1] while that for the group of years used at Agincourt is only 33·7[2], nevertheless show some very striking resemblances. The Kew values[3] are for certain days only, called ordinary days, and not as in Agincourt for all days, and this also may accentuate or otherwise the differences between the two places.

TABLE III.

AMPTITUDES AND PHASE ANGLES OF SEASONAL DIURNAL INEQUALITIES AT AGINCOURT (A) AND KEW (K).

	C_1		C_2		C_3		C_4	
	A	K	A	K	A	K	A	K
Winter........	1·37	1·93	1·61	0·96	0·48	0·45	0·40	0·27
Equinox.......	2·46	3·10	2·29	2·02	0·94	1·05	0·44	0·41
Summer.......	2·96	3·67	2·98	2·37	1·21	0·85	0·16	0·11
Year..........	2·24	2·84	2·26	1·76	0·84	0·78	0·31	0·29
	a_1		a_2		a_3		a_4	
Winter........	230	253	18	37	208	257	38	73
Equinox.......	221	238	33	51	227	245	66	79
Summer.......	212	224	37	60	249	254	114	75
Year..........	219	235	31	52	234	251	61	76

Comparing the amplitudes of the A and K values of the different terms the seasonal variations, except in the case of the 8 hour term, are seen to be the same. In the 8 hour term the Agincourt maximum is in the summer, whilst at Kew it is at the Equinox. One striking difference between the two places is the fact that at Agincourt the amplitudes of the 24 hour term and the 12 hour term are much the same, whilst at Kew that of the 24 hour term is from 1·5 to 2·0 times as large as that for the 12 hour term. The 8 hour and 6 hour terms at both places are about the same.

Looking at the phase angles the seasonal variations are seen to be almost the same except in the case of the 6 hour term where seasonal variation is large at Agincourt and almost nil at Kew. In

[1] U. S. Monthly Weather Review, April, 1902.

[2] Bulletin Mount Weather Observatory Vol. 5, Part 6.

[3] Studies in Terrestrial Magnetism, C.Chree, 1912.

order to compare the actual times the A values should be reduced to L.M.T. by adding to α_1 17 minutes of time (reduced to degrees at the rate of 1hr. to 15°) to α_2 34 minutes, &c., since the Kew values are given for Kew L.M.T. The 24 hour term then has its maximum occur earlier in the day at Kew on the average for the year by about 48 minutes, the 12 hour term 25 minutes, the 8 hour term 5 minutes and the 6 hour term at almost the same time. In the case of the 6 hour term the maximum at Agincourt as pointed out before occurs much earlier in the summer than in the winter.

It has long been accepted by magneticians that some relationship exists between magnetism and sun spots, but the nature of that relationship has not yet been definitely established. The inequality range, so far as known, is above the mean in years of many sun spots and the excess is conspicuous in years when sun spot frequency is greatest. Table IV Contrasts the Diurnal Inequality Ranges at Agincourt during a period of eleven years from 1902 to 1912, and two years of maximum sun spot frequency 1905 and 1906, and two years of minimum sun spot frequency 1902 and 1912. The mean respective frequencies as given by Prof. Wolfer[1] are 33·7, 58·6 and 4·3.

Declination Ranges at Agincourt.

Table IV.

	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.
All years.......	5·85	6·07	8·76	10·09	10·44	10·93	11·51	13·13	10·85	7·51	6·16	5·25
Max. spot years	6·82	6·32	9·82	10·98	10·95	10·54	11·54	13·15	10·96	7·44	6·76	5·09
Min. spot years	4·71	5·34	8·65	9·63	10·73	10·81	10·83	12·78	10·17	7·40	5·58	4·60

Percentage Values.

All years.......	66	68	99	114	118	123	130	148	122	85	69	59
Max. spot years	74	69	107	119	119	115	126	143	119	81	73	55
Min. spot years	56	63	102	114	127	128	128	152	121	88	66	55

The ranges are also given expressed in percentage values of their arithmetic mean, from which we can the better see the effect produced during the maximum sun spot period.

From the ranges themselves it is noticed that those in maximum spot years are throughout the year larger than in minimum spot years, but that the difference is more marked in winter than in summer, but if we now examine the percentage values we see that the effect

[1] Bulletin Mount Weather Observatory, Vol. 5, Part 6.

of the maximum spot period is to bring the winter and summer values nearer together. The seasonal diurnal inequalities during maximum and minimum spot periods are exhibited graphically in Plate III.

The diurnal inequalities for these groups of years were also treated by the method of Fourier analysis and the resulting Fourier coefficients are given in Table V.

TABLE V.

FOURIER COEFFICIENTS. DECLINATION AT AGINCOURT. ALL DAYS USING 75TH M.T. 1902–1912.

	C_1			C_2			C_3			C_4		
	All yrs.	S max.	S min.	All yrs.	S max.	S min.	All yrs.	S max.	S min.	All yrs.	S max.	S min.
Winter......	1·37	1·60	1·12	1·61	1·54	1·37	0·48	0·59	0·47	0·40	0·44	0·38
Equinox.....	2·46	2·71	2·30	2·29	2·21	2·11	0·94	0·92	1·06	0·44	0·38	0·42
Summer.....	2·96	2·96	2·87	2·98	2·92	2·88	1·21	1·19	1·24	0·16	0·20	0·16
Year........	2·24	2·41	2·08	2·26	2·17	2·12	0·84	0·85	0·91	0·31	0·29	0·28
	a_1			a_2			a_3			a_4		
Winter......	230	216	234	18	4	32	208	192	227	38	30	43
Equinox.....	221	215	218	33	29	39	227	222	230	66	58	73
Summer.....	212	208	212	37	37	44	249	241	249	114	114	120
Year........	219	212	218	31	27	40	234	224	238	61	56	67

Comparing the amplitudes of the different terms we see that during the maximum spot years the seasonal variation is reduced in each term, and that the amplitude is greater in the 24 hour term and the 12 hour term but on the average it is smaller in the 8 hour term and practically the same in the 6 hour term. A comparison of the phase angles shows that the occurrence of maximum in any term is earlier in years of minimum spots, but varies with the season and to a different amount in the different terms. In the twenty-four hour term the average time for the year is 24 minutes and varies from 12 at the Equinox to 72 in the winter. In the 12 hour term the average is 26 minutes earlier and varies from 14 in the summer to 56 in the winter. In the 8 hour term the average is 19 minutes earlier and varies from 11 in summer to 47 in winter and in the 6 hour term the average is 11 minutes and varies from 6 in summer to 15 at the Equinox These results are tabulated below in Table VI.

TABLE VI.

RETARDATION OF PHASE IN YEARS OF MAXIMUM SUN SPOTS IN MINUTES OF TIME.

Term	Year	Winter	Equinox	Summer
24 hour.......	24	72	12	16
12 "	26	56	20	14
8 "	19	47	11	11
6 "	11	13	15	6

PLATE No. 1.
ALL DAYS 1902-1912. AGINCOURT DECLINATION

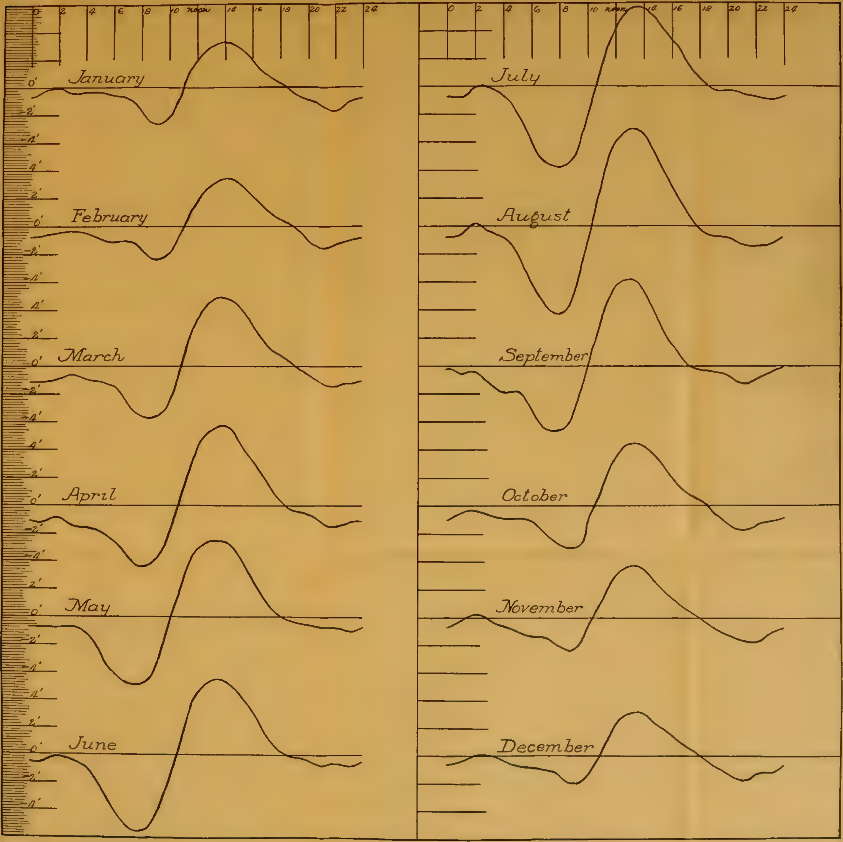
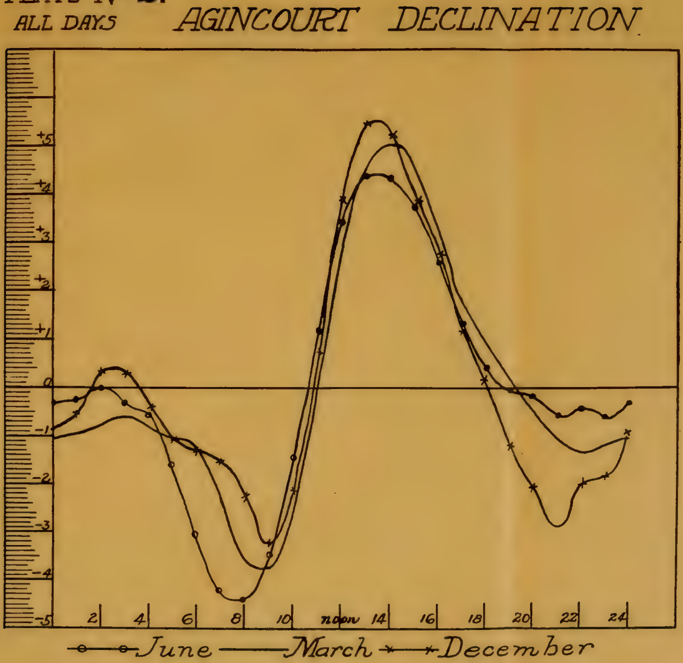


PLATE No. 2.


ALL DAYS
AGINCOURT DECLINATION
+5
+4
+3
+2
+1
0
-1
-2
-3
-4
-5
2
4
6
8
10
noon
14
16
18
20
22
24
June
March
December

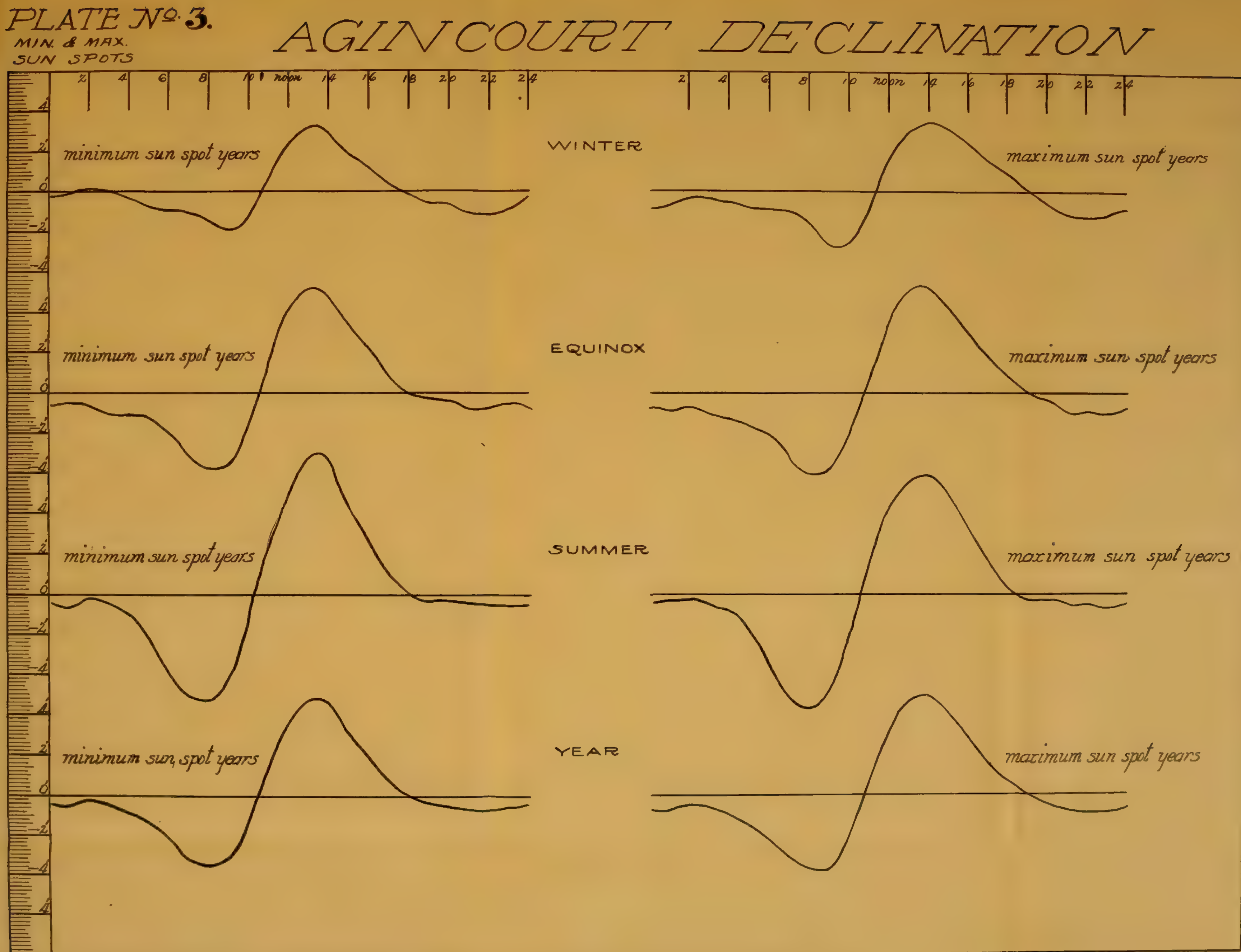


PLATE No. 3.
MIN. & MAX. SUN SPOTS
AGINCOURT DECLINATION
2 4 6 8 10 noon 14 16 18 20 22 24
WINTER
minimum sun spot years
maximum sun spot years
EQUINOX
minimum sun spot years
maximum sun spot years
SUMMER
minimum sun spot years
maximum sun spot years
YEAR
minimum sun spot years
maximum sun spot years

The Effect of an Electrostatic Field on a Two Looped Carbon Filament Lamp.

By Dr. A. S. Eve, F.R.S.C.

(Read May 27, 1914).

When conducting some experiments on point discharge it was noted that a negative discharge caused the twin loops of a carbon filament lamp to diverge violently and touch the glass sides of the lamp, sometimes until the loops broke, or adhered to the sides and fused. It was possible to produce this effect at a metre's distance, or through a board half an inch thick. On the other hand, the discharge from a positive point, if stationary, produced no effect. Some experiments were therefore made to determine the cause of this rather puzzling effect.

The terminals of the lamp were first earthed, and then the two loops could be made to diverge like the leaves of a gold-leaf electroscope, whenever a charged body, whether positive or negative, was brought near the lamp.

The lamp was then lit by passing a current through it in the ordinary way. A negatively charged body when brought up to the lamp caused divergence of the loops. A positively charged body, when moved towards the lamp, caused no movement whatever. As the positive body was being moved away, the leaves did diverge, however, and could be left parted asunder at a considerable angle, greater than in their natural position. They could then be observed through red glass with a microscope, to move back slowly to their natural position.

The return to the rest position could be greatly accelerated by bringing a few milligrammes of radium near the lamp.

None of the above experiments could be carried out with a lamp with a single loop.

The festoons of a metal filament lamp bulged outwards in a marked manner, when there was a negative point discharge near it, or when a negatively charged body was moved towards it, or when a positively charged body was removed from its neighbourhood. All these observations may be explained by the Edison effect, or thermionic current of electrons or of negative electricity leaving a glowing filament. It is an example of the valve action investigated by Fleming and explained by him in "Electric Wave Telegraphy," p. 478, 2nd edition.

It is easy for negative electricity as electrons, to leave a white hot filament, difficult for negative electricity to return to it within the exhausted bulb.

When a positive body moves towards the lamp, a number of electrons readily leave the filament by induction. As the positive body is moved from the glass, it is necessary for equilibrium either that electrons should return to the filaments, or that positive ions should move to them. This is only possible at a very slow rate. The filaments therefore are repelled, and open outwards like the two leaves of a common gold-leaf electroscope, and for the same reason. They gradually close owing to a small ionization current in the highly exhausted bulb. This ionization current can be greatly increased by bringing some radium near the lamp, hence the more rapid return to the rest position. The result of this investigation may be summarized thus: If the electric equilibrium demands that negative electricity should leave the loops the equilibrium is achieved by an escape of electrons. If equilibrium requires that positive electricity should leave the loops, then this cannot take place otherwise than slowly; the loops themselves are displaced until equilibrium is attained.

To determine by rational operations whether an algebraic curve is or is not reducible.

BY PROF. J. C. FIELDS, F.R.S.

(Read May 27, 1914.)

We suppose the variables (z, u) to be connected by an algebraic equation

$$1. \qquad f(z, u) = u^n + f_{n-1} u^{n-1} + \ldots + f_o = o$$

which equation we may assume to offer no repeated factor. Consider the product of two rational functions.

$$A(z, u) = A_{n-1} u^{n-1} + \ldots \ldots + A_o\,,$$

$$B(z, u) = B_{n-1} u^{n-1} + \ldots \ldots + B_o\,.$$

This product we can write in the form

$$2. \quad A(z, u)\, B(z, u) = f(z, u)\, g(z, u) + C_{n-1} u^{n-1} + \ldots \ldots + C_o$$

where $g(z, u)$ has the form

$$g(z, u) = g_{n-2} u^{n-2} + \ldots \ldots \ldots + g_o\,.$$

Identifying coefficients of like powers of u on the two sides of (2) we obtain

$$3. \qquad \sum_{t=r-n+1}^{n-1} A_{r-t} B_t = \sum_{t=r-n}^{n-2} f_{r-t}\, g_t\,,\ r = n,\ n+1, \ldots \ldots, 2n-2,$$

$$4. \qquad \sum_{t=o}^{r} A_{r-t} B_t = \sum_{t=o}^{r} f_{r-t}\, g_t + C_r\,,\ r = o,\ 1, \ldots \ldots, n-1.$$

If now we suppose $A(z, u)$ to represent the general rational function conditioned by a certain set of orders of coincidence $(\tau)'$ for finite values of the variable z, the necessary and sufficient condition that the function $B(z, u)$ may have for finite values of z orders of coincidence which are complementary adjoint to those furnished by $(\tau)'$ is that the coefficient C_{n-1} in (2) be integral*. In particular if $A(z, u)$ be the general rational function of integral algebraic character we shall have in $B(z, u)$ the representation of the general rational function which is adjoint for finite values of z on subjecting its coefficients $B_{n-1}, \ldots, B_o$ to just those conditions which suffice to make C_{n-1} integral. Now Hensel has shown** how to construct the general rational function of integral algebraic character by a process involving rational operations only. We shall then assume that $A(z, u)$ is the general rational function of integral algebraic character.

* On the foundations of the theory of algebraic functions of one variable. Phil. Trans. Roy. Soc., Ser. A, vol. 212, pp. 345, 347.

** Théorie des fonctions algébriques d'une variable. Acta Mathematica, vol. 18, pp. 247-317. See also H. F. Baker, Abelian Functions, pp. 105-110.

On eliminating the $n-1$ functions $g_o, g_1, \ldots, g_{n-2}$ from the $n-1$ equations (3) and the equation

$$5. \qquad \sum_{t=o}^{n-1} A_{n-t-1} B_t = \sum_{t=o}^{n-2} f_{n-t-1} g_t + C_{n-1}$$

selected from the equations (4), we obtain an expression for C_{n-1} in the form

$$6. \qquad C_{n-1} = (-1)^{n-1} \begin{vmatrix} A_{n-1} B_{n-1} & f_n & o & o \ldots\ldots o \\ \sum_{t=n-2}^{n-1} A_{2n-t-3} B_t & f_{n-1} & f_n & o \ldots\ldots o \\ \ldots\ldots & & & \\ \ldots\ldots & & & \\ \sum_{t=0}^{n-1} A_{n-t} B_t & f_2 & f_3 & \ldots\ldots f_n \\ \sum_{t=1}^{n-1} A_{n-t-1} B_t & f_1 & f_2 & \ldots\ldots f_{n-1} \end{vmatrix}.$$

In order then that the function $B(z, u)$ may be adjoint for all finite values of the variable z its coefficients $B_o, B_1, \ldots, B_{n-1}$ must be subjected to those conditions which suffice to make the expression on the right-hand side of (6) integral. Now the general rational function $A(z, u)$ of integral algebraic character can be expressed linearly in terms of a basis $\overset{(o)}{A}(z, u), \ldots, \overset{(n-1)}{A}(z, u)$ with multipliers which are integral rational functions of z. Furthermore we know that the functions of the basis can be chosen of the forms

$$7. \quad \overset{(k)}{A}(z, u) = \overset{(k)}{A_k} u^k + \overset{(k)}{A_{k-1}} u^{k-1} + \ldots\ldots + \overset{(k)}{A_o}, \; k = o, 1, \ldots, (n-1)$$

where the coefficients $\overset{(k)}{A_s}$ are rational functions of z and where in particular we may take $\overset{(o)}{A}(z, u) = \overset{(o)}{A_o} = 1$. Now in the product (2) the coefficient C_{n-1} is plainly integral if we have integral coefficients $\overset{(k)}{C_{n-1}}$ in the several products

$$8. \qquad \overset{(k)}{A}(z, u) \,.\, B(z, u), \quad k = o, 1, \ldots\ldots, (n-1).$$

In order that the function $B(z, u)$ may be adjoint for all finite values of z therefore it suffices to impose on its coefficients B_o, $B_1, \dots, B_{n-1}$ the conditions requisite to give integral character to the expressions

$$
9. \quad \overset{(k)}{C}_{n-1} = (-1)^k \begin{vmatrix}
\overset{(k)}{A}_k B_{n-1} & f_n & o \ldots\ldots\ldots\ldots o \\
\sum\limits_{t=n-2}^{n-1} \overset{(k)}{A}_{n+k-t-2} B_t & f_{n-1} & f_n \ldots\ldots\ldots\ldots o \\
\ldots\ldots\ldots\ldots & \ldots & \ldots\ldots\ldots\ldots \\
\ldots\ldots\ldots\ldots & \ldots & \ldots\ldots\ldots\ldots \\
\sum\limits_{t=n-k}^{n-1} \overset{(k)}{A}_{n-t} B_t & f_{n-k+2} & f_{n-k+3} \ldots\ldots\ldots f_n \\
\sum\limits_{t=n-k-1}^{n-1} \overset{(k)}{A}_{n-t-1} B_t & f_{n-k+1} & f_{n-k+2} \ldots\ldots f_{n-1}
\end{vmatrix}; \; k = o, \ldots, (n-1)
$$

These expressions are obtained from the expression given for C_{n-1} in (6) by indexing the functions A_o, $A_1, \dots, A_{n-1}$ and bearing in mind that we have $\overset{(k)}{A}_s = o$ for $s > k$. If the function $B(z, u)$ conditioned as above be further subjected to the conditions requisite for adjointness relative to the value $z = \infty$ it becomes the general adjoint function. If furthermore we require it to be adjoint to the order 2 relative to the value $z = \infty$ it will become the function $\phi(z, u)$ in the numerator of the general Abelian integrand of the first kind $\phi(z, u)/f'_u(z, u)$. In the case where the equation (1) is an integral algebraic equation we know* that a rational function, which is adjoint for all finite values of the variable z, must be an integral function of (z, u). In this case then in imposing on the functions B_o, $B_1, \dots, B_{n-1}$ the conditions requisite to secure integral character to the functions $\overset{(k)}{C}_{n-1}$ in (9.) we may in advance take for granted that these functions are integral polynomials in z. If the equation (1) is of degree n in (z, u) and if the terms of this degree split up into n distinct linear factors, it is readily seen that adjointness relative to the value $z = \infty$ on the part of the polynomial $B(z, u)$ simply requires that it be of degree $\overline{\overline{<}}\ n - 1$ in (z, u). Adjointness to the order 2 relative to the value $z = \infty$ would require its degree to be $\overline{\overline{<}}\ n - 3$. In passing from adjointness relative to the value $z = \infty$ to adjointness to the order 2 relative to this value of the variable we impose** on the constant coefficients in the function $B(z, u)$, already assumed to be adjoint for finite values of z, just $2n - \rho$ conditions, where ρ is the number of irreducible equations involved in the equation (1). This

* On the foundations, etc., p. 349.

** Theory of the algebraic functions of a complex variable, p. 155. Mayer & Müller, Berlin, 1906.

furnishes a process, involving rational operations only, to determine whether the equation (1) is, or is not irreducible in the case where this equation is integral of degree n in (z, u), the terms of degree n splitting up into n distinct linear factors. The process also determines the number ρ of the irreducible equations involved in equation (1.). This process would involve first the construction of a basis $\overset{(o)}{A}(z,u)$, $\overset{(1)}{A}(z,u), \ldots\ldots\ldots, \overset{(n-1)}{A}(z,u)$ for the rational functions of integral algebraic character. The coefficients B_o, $B_1, \ldots\ldots, B_{n-1}$ in the general polynomial $B(z,u)$ of degree $n-1$ in (z,u) we should then subject to the conditions implied in giving integral character to the $n-1$ expressions $\overset{(k)}{C}_{n-1}$ represented in (9.). In the resulting polynomial $B(z,u)$ we should equate to o the coefficients of all terms of degrees $n-1$ and $n-2$ and note the number of the further conditions so imposed on the constant coefficients of the polynomial. This number would be equal to $2n-\rho$.

If our equation (1.) is not of the character which we have had in view in what immediately precedes we can readily transform it to a form which will suit our purpose. If it is not already integral, a simple transformation of the dependent variable, we know, will give us an integral equation. We shall then assume that the equation (1) is integral. If the character of the equation for the value $z=\infty$ does not suit our purpose we may readily transform to one which will. That is to say we select any value $z=a$ to which correspond n different values of u. These values we shall indicate by $\beta_1, \ldots\ldots\ldots, \beta_n$. We do not need however to actually solve the equation whose roots we here indicate. Putting $\zeta=(z-a)^{-1}$, $v=\zeta^{\alpha}u$, where α is a properly chosen integer, the equation (1.) transforms to an integral equation $F(\zeta, v)=o$. The n series giving the values of v in the neighborhood of $\zeta=\infty$ evidently begin with the terms $\beta_1\zeta^{\alpha}, \ldots\ldots, \beta_n\zeta^{\alpha}$ respectively. The n orders of coincidence requisite to adjointness relative to the equation $F(\zeta,v)=o$ for the value $\zeta=\infty$ evidently all have the same value $-(n-1)\alpha$. On regarding ζ as of dimension 1 and v as of dimension α and on representing the general rational function of (ζ, v), which is adjoint for the value $\zeta=\infty$, in the form

$$10. \qquad B(z,v)=B_{n-1}v^{n-1}+B_{n-2}v^{n-2}+\ldots\ldots+B_o,$$

it is readily seen that this function is of dimension $(n-1)\alpha$. Otherwise said the degree in ζ of B_{n-r} is $(r-1)\alpha$ for $r=1, 2, \ldots\ldots\ldots, n$.

To determine then for the equation $F(\zeta, v)=o$, and therewith for the equation $f(z,u)=o$, whether it is reducible or irreducible, we begin by constructing a basis for the rational functions of (ζ, v) of integral algebraic character relative to the equation $F(\zeta,v)=o$. With the aid of this basis and by the means indicated in the earlier part of this paper we impose on the general integral rational function $B(\zeta,v)$ of dimension $(n-1)\alpha$ the conditions requisite to adjointness for all finite values of the variable ζ. We thus obtain the general adjoint function associated with the equation $F(\zeta,v)=o$. In this

function $B(\zeta, v)$ the coefficients B_{n-1} $B_{n-2}, \ldots, B_o$ are polynomials in ζ of degrees o, α, $2\alpha, \ldots\ldots, (n-1)\alpha$ respectively. Here B_{n-1} is an arbitrary constant. Equating this constant to o and reducing the degrees of $B_{n-2}, \ldots\ldots, B_o$ to $\alpha-2$, $2\alpha-2, \ldots\ldots, (n-1)\alpha-2$ respectively, we force the function $B(\zeta, v)$ to have for the value $\zeta=\infty$ orders of coincidence which are adjoint to the order 2. Noting the actual number of the extra conditions so imposed on the constant coefficients of the function $B(z, v)$ we otherwise know that this number must be $2n-\rho$. We thus determine the number ρ of the irreducible factors in $F(\zeta, v)$ and therewith the number of such factors in $f(z, u)$.

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SECTION III

SERIES III DECEMBER 1914 VOL. VIII

Note on the Possible Effect of a Longitudinal Magnetic Field on a Radial Current in a Bunsen Flame.

BY A. A. SCOTT.

(Presented by Dr. A. S. Eve, F.R.S.C.)

(Read May 28, 1914)

In the following investigation, although no positive results were obtained, it was thought advisable to place on record the magnitude of the various quantities entering into the experiment for the benefit of workers in the same field.

Strutt[1] has recently shown that the difference of potential necessary to produce a discharge of electricity between a long cylindrical electrode and an axial electrode in an exhausted vessel is greatly diminished by a longitudinal magnetic field. Horton[2] has made a similar experiment using a hot platinum strip as an electrode.

It seemed possible that an effect might be obtained even at atmospheric pressure when the flame of a Bunsen burner was employed as a conducting medium. Accordingly the apparatus illustrated herewith was arranged. (Fig. 1)

The flame of a Bunsen burner was surrounded by a cylinder of brass gauze in contact with the flame. A brass rod occupied the axis of the cylinder. An electromagnet was placed in such a position that a longitudinal magnetic field could be produced in the flame by means of annular pole pieces. The gauze and the rod were connected to a battery, a moving coil galvanometer and a reversing key through a resistance of thirteen megohms. The gauze and the pole pieces were insulated with mica.

The results for an unsalted flame are shown graphically by the following curves. The abscissae represent volts and the ordinates divisions of the galvanometer scale. Small currents were obtained

[1] Strutt, Pro. Roy. Soc., vol. lxxxix, p. 68, 1913. Townsend, Phil. Mag., Oct. 1913.

[2] Horton, Phil. Mag., Nov. 1913.

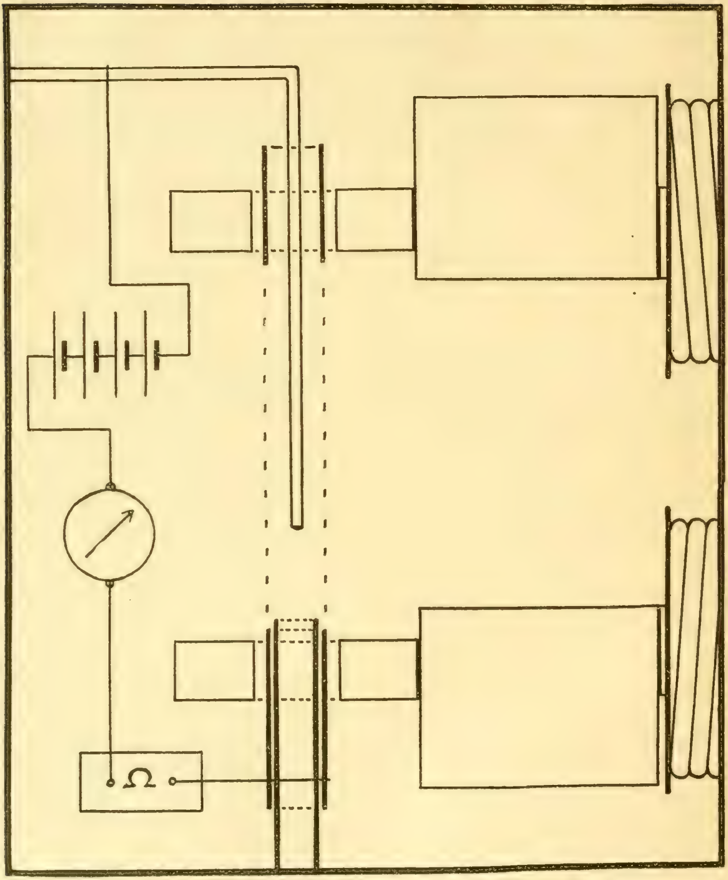
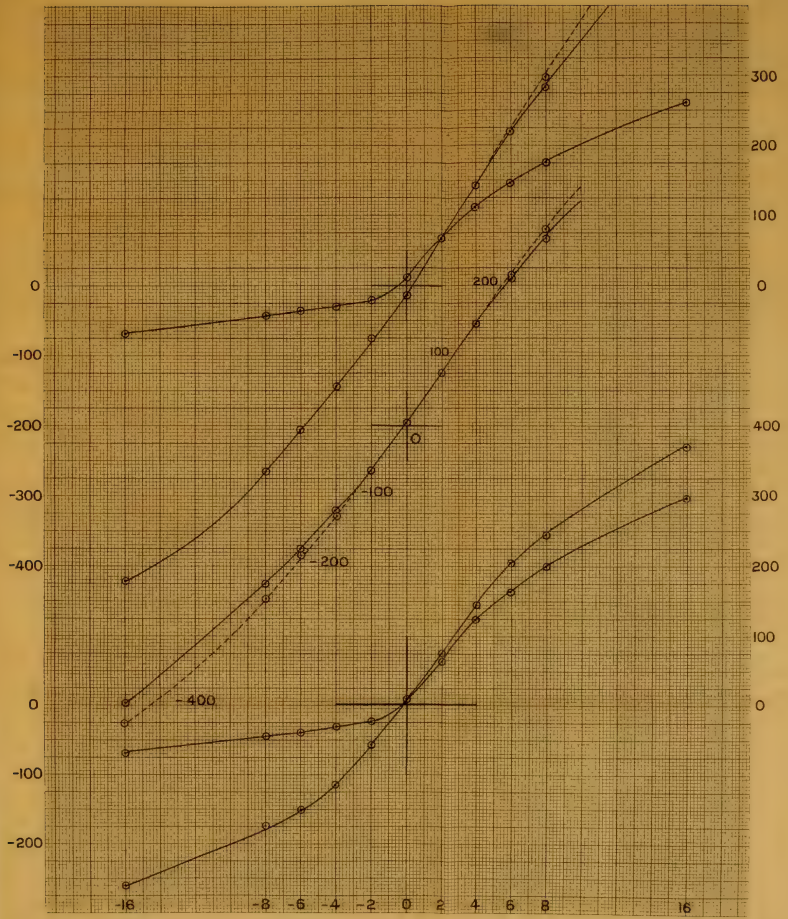


FIG. 1.



0
-100
-200
-300
-400
0
-100
-200
300
200
100
0
400
300
200
100
0
200
100
0
-100
-200
-400
-16
-8
-6
-4
-2
0
2
4
6
8
16

with a low temperature flame, while large ones were produced by a hot flame. The curves resemble very closely in magnitude and in form those obtained by Prof. H. A. Wilson and described in his book on "The Electrical Properties of Flames."

When the magnetic field was applied, the change in current was feeble or null. Even when the rod was coated with a salt, although the conductivity of the flame was greatly increased, the change due to the magnetic field remained uncertain. This was due either to the unsteadiness of the flame or to the weakness of the field which was about 300 gauss. The currents employed were of the order of 10^{-7} ampere. Professor H. A. Wilson has suggested that as the Hall effect in a flame is proportional to the square of the magnetic field, it might be a better arrangement to make the flame pass up the axis of a vertical solenoid. The wire could be wound on a brass cylinder with a double wall, through which water circulated to keep it cool, the cylinder replacing the gauze as an electrode.

Contact Resistances of Metals and Alloys.

By H. E. Reilley, M.Sc.

Demonstrator of Physics, McGill University

(Presented by Dr. H. T. Barnes, F.R.S.)

(Read May 28, 1914).

In 1910 two Japanese scientists, Kimura and Yamamoto, published in the Coll. Sci. and Engin. Mem. Kyoto 2. 4. a paper on the unilateral conductivity of minerals in contact. These experimenters showed that the power of rectification diminishes with increasing pressure, which phenomenon was found to be most marked in the case of copper pyrites, of covelline and of bornite. In 1913 Mr. A. L. Clark, as a result of extensive research on carbon contacts, observed that the resistance for loose contacts increased with time. These with several other papers giving similar results contain the only available data on the subject of contact resistances. Hence the following experimental work has been undertaken to investigate first, the relation between the pressure and resistance of various contacts of metals and alloys. Such data will be of interest, for instance, in the construction of delicate relays. A second phase of the subject considered is the effect on the pressure-resistance ratio of conductors due to careful cleaning of the surfaces of the substances forming electrical contact.

(a) Method of procedure.

In general the method of attacking these questions was, as outlined by Dr. H. T. Barnes, to make an adjustable contact of the alloy or metal under investigation and to connect this contact as a shunt with a very sensitive Broca galvanometer using in the experiment a current of $1x10^{-5}$ ampéres. Fig. 1 shows the arrangement of the apparatus:—

B is a storage battery having an E. M. F. of about 2 volts.

M is a megohm consisting of resistance coils of 100,000, 200,000, 300,000 and 400,000 ohms.

G is a Broca galvanometer, No. 4703. A scale and a reflected spot of light were employed to indicate the current passing through the galvanometer.

R is the contact of metal or alloy. It consists of two wires placed at right angles to each other.

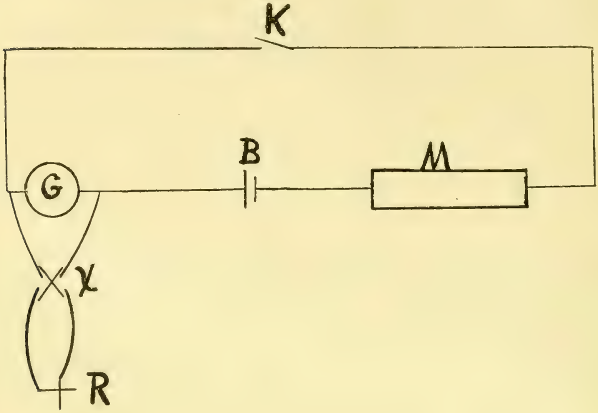


Fig. 1.

X is a reversing key by means of which the current can be sent through the contact wires in either direction.

K is a key in the main circuit.

(b) Calibration of the galvanometer scale.

A simple method was used in obtaining the calibration curve of the galvanometer. First, the control magnet of the galvanometer was placed so that, when all the current in the circuit passed through the galvanometer, the deflected spot of light was at one end of the scale. Then the contact wires were pressed together and the resistance in the megohm was adjusted until the deflected spot of light was near the other end of the scale. This condition was obtained when the 200,000 ohm coil was placed in the circuit, thus giving a current of 1×10^{-5} ampéres. Next, a standard resistance box was substituted for the contact wires; and by putting into the circuit various coils of the resistance box it was possible to calibrate the scale for all deflections corresponding to resistances from infinity to zero. Fig. 2 shows the curve as plotted from a scale six times as large.

The megohm prevented a sudden lowering of the E.M.F. of the battery, so that there was no perceptible change in the current even after the apparatus had been in use for several days.

The resistance coils of the galvanometer were equal to about 100 ohms. Care was also taken in the calibration to have the same leads in the circuit in order that the total resistance of the various parts of the circuit would be the same for the contact wires as when the standard resistance box was substituted.

(c) Details of contact formation.

Contact between two pieces of the wire conductor was obtained by arranging the wires at right angles to each other, one of which was stationary, while the other one was movable. The former was held firmly in a brass clamp, 4 cms. long, 1 cm. wide and ¾-cms. in thickness. The upper adjustable jaw of the clamp was 2 cms. long. Through it passed two upright brass screws, in each of which was drilled a hole to admit the end of the fixed or stationary wire. The upright screws also served as terminals for the shunt leads, and when tightened held the wire firmly. At right angles was another clamp to which was attached the second wire of the contact. Considerable difficulty was experienced in getting rid of the effects due to the elastic proper ties of the various conductors. This was accomplished, however, by the use of a flat hinged brass jaw, to which the wire could be soldered. The jaw itself was 6·3 cms. long varying in width from 1·5 cms. at the hinge to ·5 cms. at the smaller end. Through the end of the heavy brass clamp was drilled a small hole to contain the pivotal hinge; while to the other end was soldered a small brass hook. This second clamp was similar to the one holding the stationary wire in that it had two upright brass screws, one a terminal for the shunt lead and the other a terminal for two small flexible copper strands soldered to the hinged brass jaw to insure good electrical connection between the clamp and the jaw. The two clamps with their attachments were made fast to a wooden base so constructed that it could be weighted to prevent shifting of its position.

(d) Method of varying and measuring the contact pressure.

The hooked end of the hinged jaw, referred to in the preceding section, was attached to one end of the beam of a very sensitive balance, and by merely applying pressure to the other pan of the balance the contact pressure could be increased or decreased as desired. A glass beaker containing water was used in producing the necessary pressure by placing it on the balance pan. Water was added or withdrawn in large or small quantities as the occasion demanded to secure a change of pressure.

It was not necessary, however, to weigh the liquid at each observation as shown by the following. Dipping into the liquid was a finely drawn out glass tube, supported by an upright iron stand. The lower end of the tube was bent so as to be parallel to the surface of the water. Held vertically by another support was a graduated 1 c. c. glass tube, joined to the other by heavy walled rubber tubing and a tap. To the upper end of the vertical graduated tube was attached a three-way tap leading to an exhaust pump. Hence to obtain the absolute change of pressure required to produce good contact it was only necessary to open the taps, let the water flow down into the beaker on the scale-pan noting the positions of the water column in the graduated tube at the moments when the spot of light on the scale indicated an infinite resistance and a zero resistance or good contact. The difference between those positions of the water column is then the absolute pressure required to produce good contact. To decrease the contact pressure the water was drawn up by the exhaust pump, observations of the water level being made again as before. Thus the effects due both to evaporation and to changes in the weight on the hinged contact jaw for the wires of various sizes and lengths were eliminated for each observation.

(e) Devices to prevent "bumping" together of contacts.

As already stated in a previous part of this paper, the lower end of the tube dipping into the beaker was bent so that it was parallel to the surface of the water. Hence there was no vertical force component due to the inflow or withdrawal of the water.

Furthermore, the two taps made it possible to regulate the rate of change of pressure. In the actual experimental work the rate of change was from 10 to 20 mgms. per minute.

(f) Means of producing steadier deflections.

A further noteworthy feature of the form of the apparatus used was that the force arms of the contact could be varied in length. It was convenient to use arms $6 \cdot 3$ and $3 \cdot 15$ cms. long, the former being the force arm, the latter the resistance arm. By this device the change of pressure as recorded on the graduated 1 c.c. tube was lessened, while at the same time the distance, the contact wire moved for a given change of pressure, was diminished. The effects due to the smaller external vibrations were thus removed; it was easier to obtain steady readings, and the experimenter was enabled to obtain points on the pressure-resistance curve between an infinite resistance and good contact.

Results.

The following table indicates the substances examined, the absolute pressure required to make good contact (a) in air (b) in an oil bath, and the residual resistance:—

Substance.	Pressure in air.	Pressure in oil—(Approx. value).	Residual Resistance.
Fery Wire	200 mgms.	160–170 mgms.	1·5ohms.
German Silver	220 "	180 "	·2 "
Platinum Silver	100 "	40 "	·4 "
Constantan	160 "	100 "	–·5 "
Manganin	48 "	30–40 "	·4 "
Copper	60 "	50 "	0·
Silver	44 "	34 "	·3 "
Nickel	140 "	50 "	1·0 "
Platinum	50 "	25 "	·6 "
Gold	100 "	25 "	·5 "
Gold plated manganin	40 "	20 "	·2 "
Aluminum	180 grams.	100 grams	·2 "

An examination of the preceding table shows that the pressure required to produce good contact in the case of the metals is in general less than that of the alloys. The exceptions so far as these experiments have been carried out are manganin, nickel, gold and aluminum. Manganin and goldplated manganin rank with the metals, requiring a pressure somewhat less than 50 mgs., while a pressure of 180 grams was necessary to produce a contact of small resistance for aluminum. Fig 3 gives the curves for gold. Curve No. 1 shows that about 100 milligrams is the good contact pressure. It was observed at the time when the gold was being examined that the atmospheric humidity was above 70 %. This may account for the high pressure value obtained. Curve No. II is the result of observations made about twelve hours later. It shows that the resistance has increased a considerable amount and also that the contact pressure has changed.

Fig. 4 gives the curves for aluminum, indicating the very high contact pressure of 150 to 180 grams referred to above. These curves also show that the resistance of the aluminum has increased with time, curves Nos. II and III being the results of observations taken one or two hours later than those for curve No. I. Fig. 4 also includes curves for several alloys and nickel. It will be noticed that there are two curves for platinum-silver, one being that obtained as the contact resistance was reduced from ∞ to 0, and the other in changing the resistance from 0 to ∞. As can be seen, these two curves show a difference of resistance for given pressures. Fig. 5 contains two curves for fery wire indicating the same phenomenon of unilateral conductivity.

No pressure-resistance curves have as yet been obtained for the various substances when in an oil bath, but the absolute pressures have been determined. The table given in this paper shows that in every case the contact pressure was lessened when the contact wires were at first placed in the bath. But an increase took place very quickly in many cases. In others, for instance nickel, the pressure remained constant at 50 mgms. during a period of more than an hour. So that the effect of the oil bath is to produce in some contacts a temporary diminution of the pressure, while a permanent decrease seems to be the effect in other contacts.

Effects of Cleaning Surface of Conductors.

All the wires used in the preceding determinations were carefully cleaned with very fine emery paper and chamois. As indicated by the curve for cleaned copper, 40 to 60 milligrams of pressure will produce a contact of low resistance. To ascertain the comparative pressure for clean and unclean wires, a copper wire, such as may be found in any laboratory, was tested. The consecutive pressure values obtained were approximately 200, 90, 80 and 70 grams, but 65 grams would not produce good contact even after a score of observations.

Conclusions.

These results as given above for the cleaned wires of metals and alloys seem to substantiate the theory that contact resistance is largely due to a "cushion" effect produced by the formation of a sub-chemical film on the surface of the substance, which film in some cases ultimately becomes the oxide. There are various reasons for drawing such a conclusion. First, the resistance of several substances increased an appreciable amount after an hour or two had elapsed from the time the first observation was made. Secondly, the resistance of the contact was greater in changing from ∞ to 0 than from 0 to ∞. The explanation is that when the surface film has been broken through or "punctured," the resistance is lessened by a considerable amount. A thorough investigation of this point has not been completed as all the observations were made before the results were examined. Hence in some cases only one curve has been obtained, nearly all the readings having been taken when the resistance was changing from ∞ to 0. Thirdly, the oil bath prevented the surface film from forming as quickly as in air. Therefore the contact pressure in oil was at first lower than the values obtained when the contact was exposed to the

atmosphere. A surface film was formed slowly by the oil and the occluded air of the contact wires. And lastly, the most conclusive evidence supporting this explanation of the contact resistance is the fact that by passing a larger current through the wires in the oil bath, when the film has "thickened," both the contact pressure and the resistance are reduced to values obtained when first observations were made.

CONTACT RESISTANCE *Reilley*

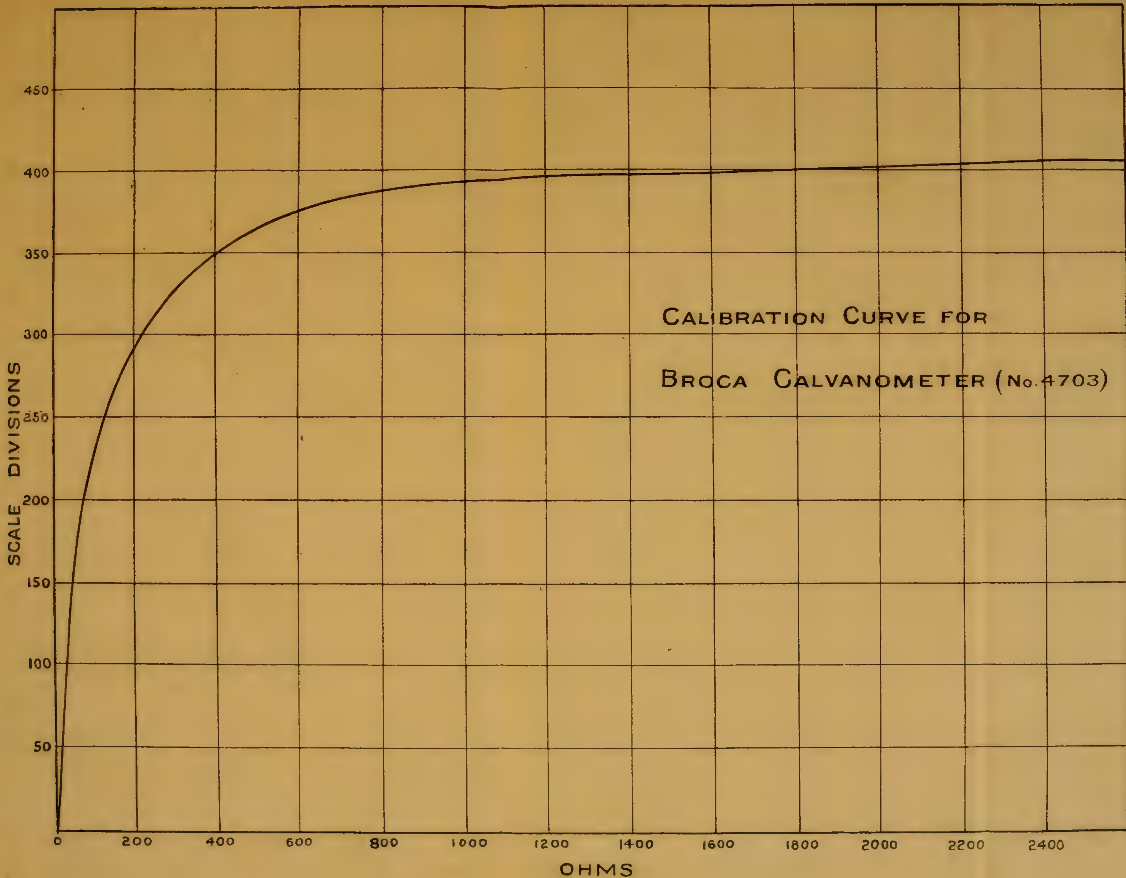


Fig. 2.

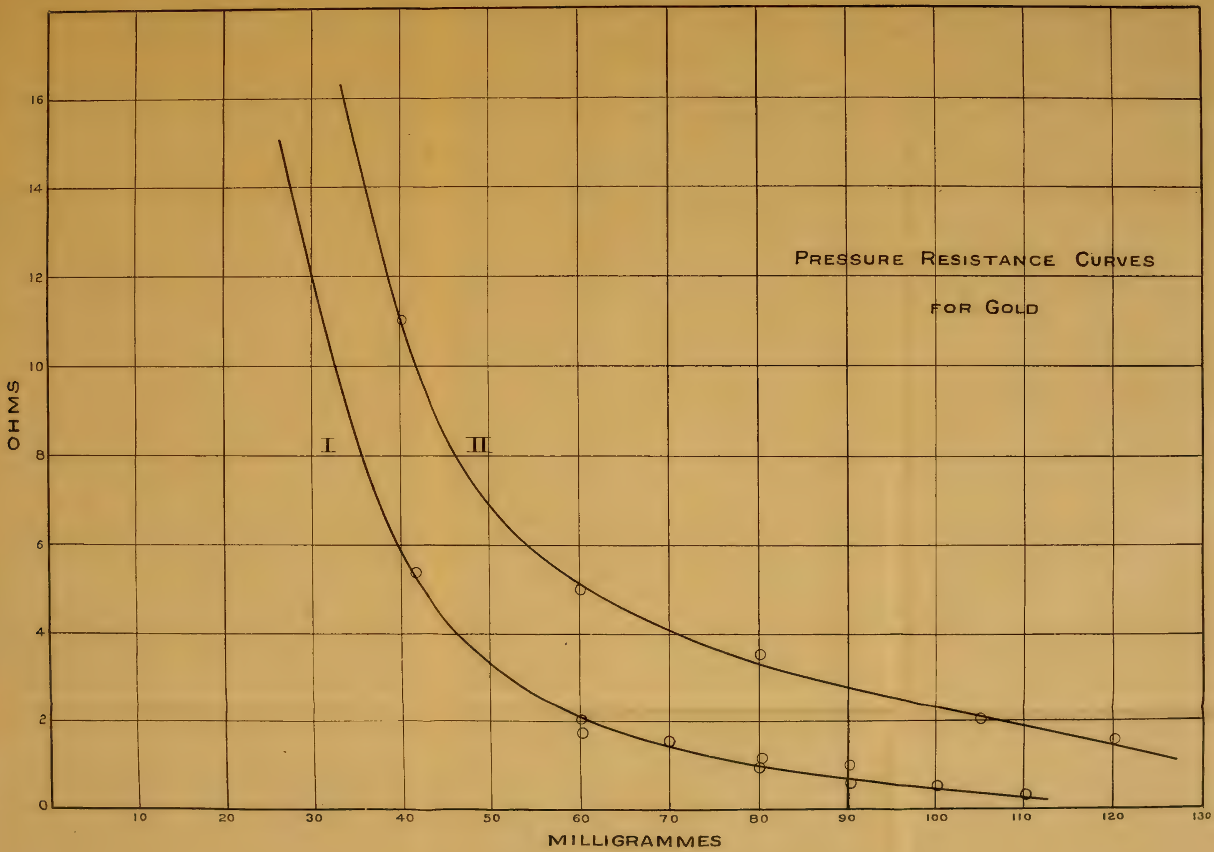
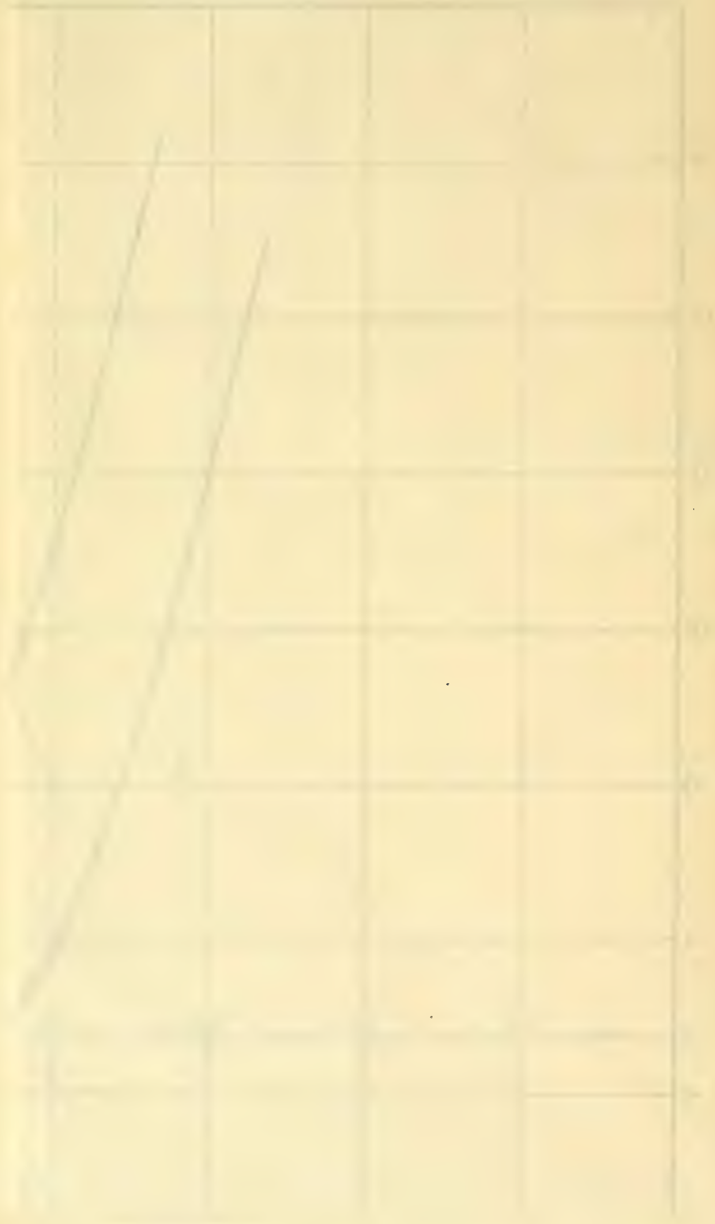

PRESSURE RESISTANCE CURVES
FOR GOLD
OHMS
16
14
12
10
8
6
4
2
0
10
20
30
40
50
60
70
80
90
100
110
120
130
I
II
MILLIGRAMMES

Fig. 3.



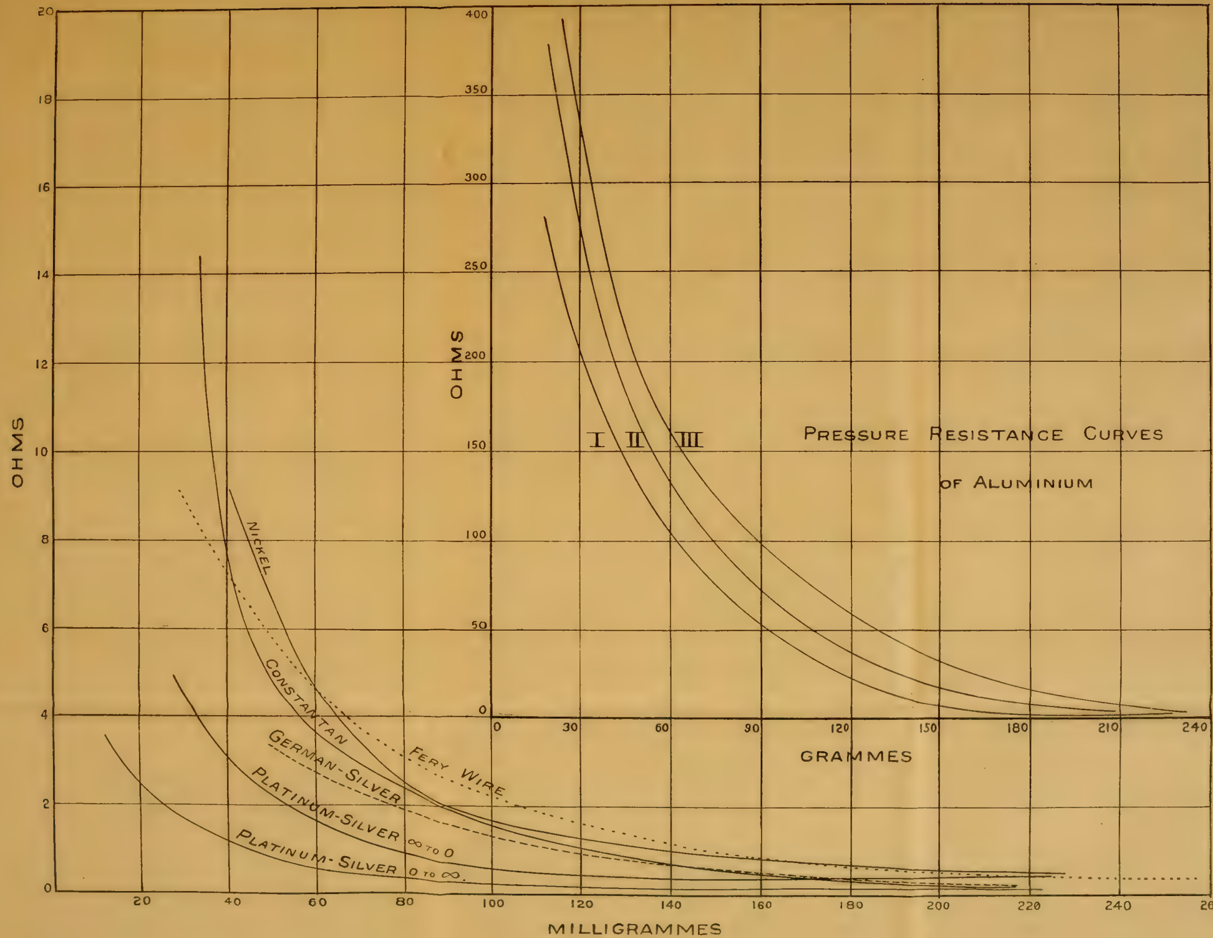

OHMS
MILLIGRAMMES
OHMS
GRAMMES
PRESSURE RESISTANCE CURVES OF ALUMINIUM
I II III
NICKEL
CONSTANTAN
FERY WIRE
GERMAN-SILVER
PLATINUM-SILVER ∞ TO 0
PLATINUM-SILVER 0 TO ∞.
20 18 16 14 12 10 8 6 4 2 0
20 40 60 80 100 120 140 160 180 200 220 240 260
400 350 300 250 200 150 100 50 0
0 30 60 90 120 150 180 210 240

Fig. 4.

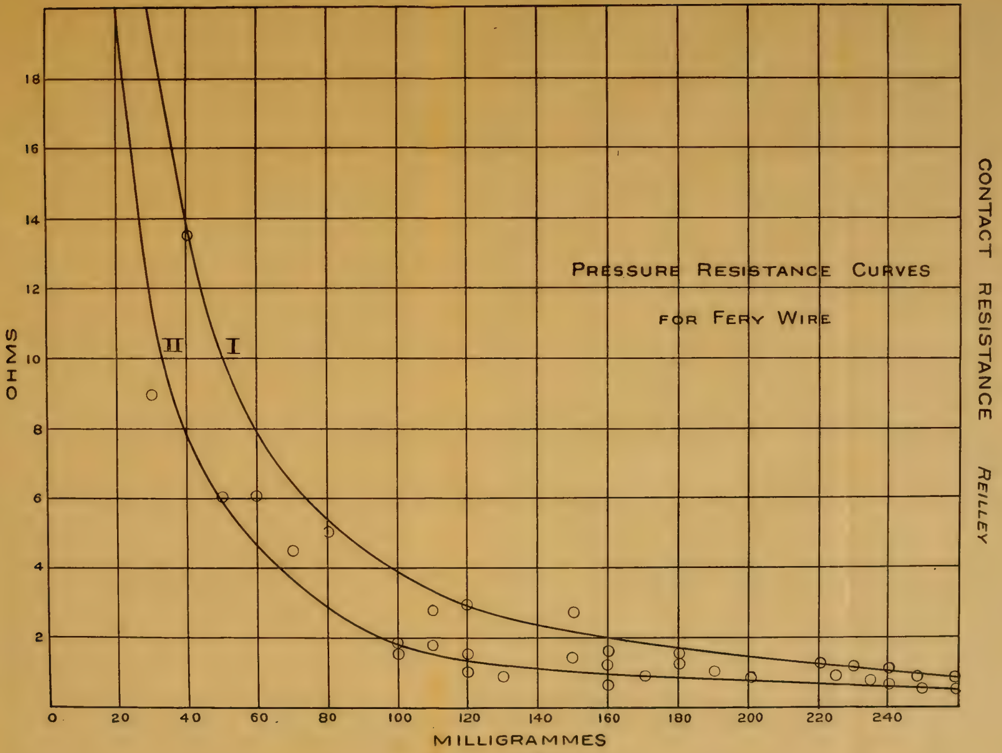

PRESSURE RESISTANCE CURVES
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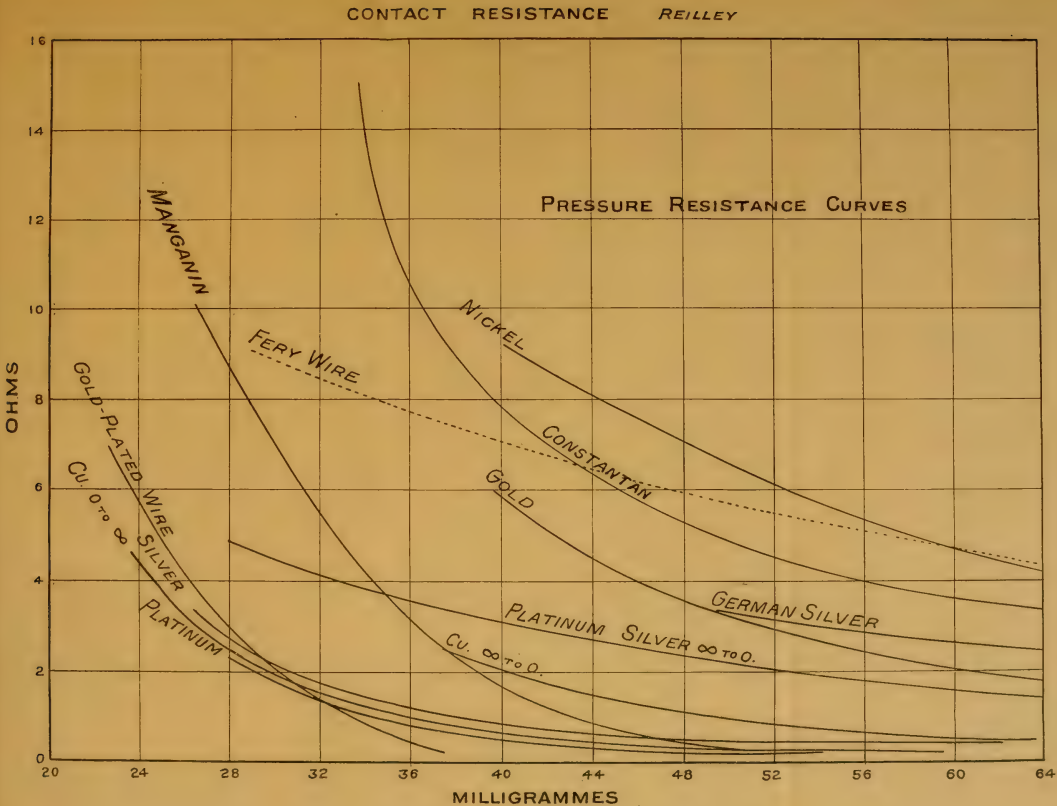
Fig. 5.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44
48
52
56
60
64
MANGANIN
NICKEL
FERY WIRE
GOLD-PLATED WIRE
CONSTANTAN
GOLD
CU. 0 TO ∞
SILVER
GERMAN SILVER
PLATINUM
PLATINUM
SILVER ∞ TO 0.
CU. ∞ TO 0.

Fig. 6.

On Osmosis in Soils.

(*By C. J. Lynde, Professor of Physics, and J. V. Dupré, Research Assistant under the Dominion Grant for Agriculture. Macdonald College, P.Q., Canada.*)

(Presented by PROF. H. T. BARNES).

(Read May 27, 1914).

For the sake of clearness we have divided this paper into two parts.

In part one we describe experiments in which we measured the osmotic pressures obtained when we used a column of very fine soil as a semi-permeable membrane and a concentrated soil solution as the active solution.

In part two we describe an experiment to determine whether or not the pressures observed were due simply to the swelling of the soil column.

HISTORICAL.

It is usually stated that soil water is subject to threee types of movement, namely, gravitational, capillary and thermal. In studying the movement of soil moisture I was gradually led to the conclusion that in producing this movement there is some agency at work, other than those given above.

In considering what this agency might be I was led to the following theory.

THEORY THAT SOILS ACT AS SEMI-PERMEABLE MEMBRANES.

It is possible: (1) that soils act as semi-permeable membranes; (2) that the greater the depth of the soil the greater is its efficiency as a semi-permeable membrane; (3) that a soil solution moves through the soil by osmotic pressure from points where the solution is less concentrated to points where it is more concentrated.

In 1912 I read two papers[1] before the American Society of Agronomy at their Meeting at Lansing, Mich. The results presented

[1] "Osmosis in Soils," Journal of Physical Chemistry, Vol. 16, No. 9, December, p. 759 (1912).

indicated that the above theory is true for a heavy clay subsoil. It acts as a semi-permeable membrane; its efficiency as a semi-permeable membrane increases with its depth; and the soil moisture moves through the soil membrane from points of less concentration to points of greater concentration.

In 1913 I had the honor of reading a paper[1] before this society in which I gave some results obtained by using the soil constituents as semi-permeable membranes. In the mechanical analysis of soils, the soils are divided into grades according to the size of soil particles. The grades are known as sands, silt and clay. These are the soil constituents.

We found that the smaller the soil particles in a soil constituent the greater is the efficiency of the constituent as a semi-permeable membrane.

In the papers read in 1912 the greatest osmotic pressure recorded was 5·6 grams per square centimeter. This corresponds to a water column about 2 inches high.

In the paper read beofre this society in 1913 the greatest osmotic pressure recorded was 42·5 grams per square centimeter, corresponding to a water column about 16 inches high.

This year we have carried this further and we have obtained, as is shown below, an osmotic pressure of 352 grams per square centimeter corresponding to a water column of over 11·5 feet.

Part I.

On the Osmotic pressure obtained by using a column of very fine soil as a semi-permeable membrane, and a concentrated soil solution as the active solution.

How the Soil Was Prepared.

We used a loam soil which we knew contained a considerable amount of very fine soil. The loam was soaked in bulk over night in a pan of distilled water. From this mud eight shaker bottles were loaded each with approximately, 5 g. of soil, 150 c.c. distilled water and 5 drops of ammonia.

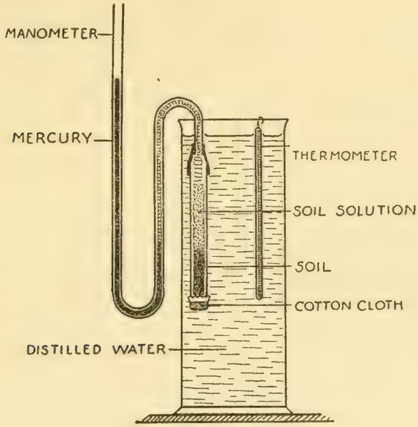
After one hour in the shaker the bottles were allowed to stand for 15 minutes and the liquid was decanted into an enamelled pan which was then placed in an oven at 110°C. A further 150 c.c. of distilled water was then added to each bottle and the bottles were again shaken for 1 hour. After standing for 15 minutes the liquid was again decanted and added to the liquid obtained from the first shaking. To sterilize the liquid and free it from ammonia it was

[1] "On Osmosis in Soils." Translations of the Royal Society of Canada, Third series, Vol. VII (1913).

brought to about 100°C. in the oven and then placed over a burner until decided ebullition took place. The liquid was allowed to cool over night and was then decanted into a 2,000 c.c. cylinder. It was allowed to settle in the cylinder for seven days.

A cylinder was filled with liquid in a similar manner each day for seven days. After seven days the liquid in the first cylinder was decanted from the sediment and evaporated down in an enamelled pan in an oven at 110°C.

Next day the liquid from the second cylinder was added to this pan. This was continued each day for seven days. The liquid was finally evaporated down until it was a rather thick syrup.



HOW THE APPARATUS WAS SET UP.

The apparatus used is shown in the figure above. Two glass tubes approximately 15 cms. long and 1 cm. diameter were closed at one end with one layer of cotton cloth. They were then filled with the thick hot liquid, and placed in cups of the centrifuge. The cups were filled with hot distilled water to the level of the liquid in the tubes. The centrifuge was run at top speed for 15 to 30 minutes; the liquid was then decanted from the sediment and replaced by fresh thick liquid. This was continued until the sediment reached the desired thickness or until the thick liquid was exhausted. The centrifuge made 1,300 r.p.m. and the center of the column of sediment in each tube was 25 centimeters from the center of the axes of the centrifuge.

The liquid remaining in the tubes after the last settling was used as the soil solution.

An open arm mercury manometer was then attached to each tube and the tubes were placed in distilled water.

After the observations on the pressure had been completed, the electrical resistance of the soil solutions was compared to that of a ·02N. KCl solution.

We made two separate experiments and repeated the second experiment twice using the same soil and solution as in the second experiment.

Results.

TABLE I.

GIVING THE OSMOTIC PRESSURE OBSERVED IN THE FIRST EXPERIMENT.

Tube	Cms. Hg.	Cms. H_2O	Feet H_2O.
(1)	15·5	210·8	6·9
(2)	23·8	323·7	10·6

Duration of experiment 14 days; depth of soil columns (1) 7 cms.; (2) 4 cms. Resistance of soil solutions compared to ·02N. KCl solution. Soil solution 70 ohms, ·02N. KCl solution 270 ohms at 18°C.

TABLE II.

GIVING THE OSMOTIC PRESSURE OBSERVED IN THE SECOND EXPERIMENT.

Tube	Cms. Hg.	Cms. H_2O.	Feet H_2O.
(1)	25·9	352·2	11·5
(2)	lost		

Duration of experiment 6 days; depth of soil column (we forgot to take this but it was approximately 6 cms.) Electrical resistance of soil solution =60 ohms., ·02N. KCl=270 ohms, at 18°C.

TABLE III.

GIVING THE OSMOTIC PRESSURES OBSERVED IN REPEATING THE SECOND EXPERIMENT TWICE.

Trial	Cms. Hg.	Cms. H_2O.	Feet H_2O.
(1)	17·0	231·2	7·6
(2)	20·3	276·1	9·0

Duration of first trial, three days. The manometer was accidentally broken. We replaced the manometer and started the experiment again. Duration of second trial, ten days.

PART II.

An experiment to determine whether or not the pressure observed is due to swelling of the soil column.

It occurred to us that the pressures we observed might be due to the swelling of the soil column. To settle this point we prepared soil as above allowing it to settle in water for 4 days. We then set up two tubes as usual and measured the pressure developed. We also set up a third tube in the same way except that we inserted a solid rubber stopper instead of the layer of cotton cloth. Thus no movement of moisture due to osmotic pressure could occur. If then we observed a pressure it could not be due to osmotic pressure but must be due to some other cause such as the swelling of the soil column.

The two tubes set up in the ordinary way developed osmotic pressures, but less than those given above.

The third tube with the solid rubber stopper not only did not develop any pressure, but gave a negative pressure. This indicates that the soil solution is absorbed and that the total volume, soil plus solution, decreases.

We then poured the soil solution out of the tube with the rubber stopper and added distilled water. Again a negative reading was obtained and much greater than with the soil solution. This indicates that the soil column absorbs water more readily than it absorbs soil solution and that there is a greater decrease in total volume.

Results.

TABLE IV.

GIVING THE OSMOTIC PRESSURES OBSERVED IN TUBES (1) AND (2) AND THE NEGATIVE PRESSURES OBSERVED IN TUBE (3.)

Tube	Pressure cms. Hg.	Time in days
(1)	8	15
(2)	9·1	15
(3) with soil solution	—3·7	8
(3) with distilled water	—10·3	15

Depth of soil columns (1) 7·5 cms., (2) 8·5 cms., (3) 5·5 cms. Electrical resistance of soil solutions (1) 70 ohms, (2) 85 ohms, (3) 80 ohms, of ·02N. KCl solution 270 ohms at 18°C.

Conclusions.

Part I.

Using a concentrated soil solution as solution and a column of soil approximately 2·5 inches deep as semi-permeable membrane we have observed an osmotic pressure equal to the pressure exerted by a column of water 11·5 feet high.

Part II.

(1) The results indicate that the pressures observed are not due to the swelling of the soil column.

(2) They indicate also that the pressures observed are due to osmosis, as follows: (a) the semi-permeable membranes used in investigations on osmotic pressure are colloids; (b) there is strong evidence that the action of semi-permeable membranes is one of unequal absorption. One liquid is absorbed more readily than the other and the movement is toward the liquid least absorbed. The soil we have been using as a semi-permeable membrane resembles the ordinary semi-permeable membranes in both ways: (a) it is quite probable that it is in a colloidal state; (b) it absorbs water more readily than it does a soil solution and the movement is toward the liquid least absorbed, namely, toward the soil solution.

The Cubical Expansion of Vitreous Quartz.

BY N. E. WHEELER, M. SC.

Lecturer in Physics, McGill University

(Presented by DR. H. T. BARNES, F.R.S.)

(Read May 27, 1914).

The measurement of the thermal expansion of vitreous quartz, or fused silica, has been the subject of numerous investigations in recent years. The importance of an accurate knowledge of its linear coefficient has been recognized, especially in connection with its use in thermometry, and in the construction of standards of length. Recently, in connection with the careful determination of the coefficient of expansion of mercury, the question has arisen as to whether the cubical expansion of a silica dilatometer bulb can, with sufficient approximation, be calculated from its linear expansion measured in one direction only. In view of these facts, and of the importance of an accurate knowledge of the expansion coefficient of a suitable standard liquid, a résumé of the more important papers dealing with measurements of the expansion of fused quartz may perhaps be of some general interest.

I. HISTORICAL DEVELOPMENT.

In 1901 in a lecture[1] before the members of the Royal Institution, W. A. Shenstone summarized much of the work which had, up to that time, been done on fused quartz. As he pointed out, the manufacture of fused quartz dates back to 1839 when Gaudin[2] made fine threads of quartz and noted their great strength which approximates that of steel. Gaudin also produced very hard small pellets of fused quartz, by dropping the molten material into cold water, and observed that in this form quartz is inactive to polarized light. He attributed the permanently high viscosity, which renders possible the production of remarkably fine and uniform fibres of quartz, to a constancy of temperature produced by continual evaporation.

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[1] Proc. Roy. Inst. 1901; Nature *64*, pp. 65-67, 1901; Chem. News *83*, pp. 205-207, 1901.

[2] Comptes Rendus *8*, pp. 678-679, 711-713, 1839.

Three decades later, in 1869, Gautier[1] succeeded in constructing capillary tubes and spirals of fused quartz which he exhibited at the Paris Exhibition in 1878.

Then after the lapse of nearly two decades, in his search for a suitable material for suspension fibres, Prof. C. V. Boys[2] again discovered this material. To him is due the credit of having been the first to recognize the great value of fused quartz. In 1889[3], in lecturing before the Royal Institution, Prof. Boys described his well-known method for the production of exceedingly fine, uniform and strong quartz fibres by means of a cross-bow and arrow, and demonstrated the measurement of the Newtonian constant of gravitation by means of an instrument no bigger than a galvanometer. So fine was he able to produce these quartz suspensions that he could detect the gravatational force between two No. 5 shot, and he even estimated that a grain of quartz just large enough to be visible would furnish material sufficient for 1000 miles of the finest fibre which he produced.

Boys' work was followed by the advances of Shenstone and others until now the manufacture of fused silica apparatus, even of complicated form, has been undertaken on a commercial scale.

The combination in a single material of very many desirable physical properties has led to the use of fused silica for many purposes. It is highly refractory,—its melting point, which is not very definite, being higher than that of platinum, though it softens appreciably below 1,500°C. It possesses remarkable transparency, even for very short wave-lengths. At high temperatures it is extremely ductile, while at moderate temperatures, it possesses a hardness greater than that of ordinary glass, and an almost perfect elasticity. It is a very good electric insulator even in an atmosphere containing much water vapour. The smallness of its thermal expansion and thermal hysteresis together with its resulting ability to withstand sudden changes of temperature[4] has led to its adoption as a desirable material for accurate dilatometer bulbs and for standards of length.

On the other hand, it becomes slightly permeable to hydrogen[5] and helium[6] at about 900°C. Above this temperature it also devitrifies with a gradual increase in length, accompanied probably by a slight change in other properties. Though devitrification may take place

[1] Comptes Rendus *130*, p. 816, 1900.
[2] Phil. Mag. (5) *23*, pp. 489-499, 1887.
[3] Nature *40*, pp. 247-251, 1889; Science *14*, pp. 61-62, 1889.
[4] Dufour Comptes Rendus *130*, pp. 1753-1754, 1900.
[5] Villard " " *130*, pp. 1752-1753, 1900.
[6] Sir William Crookes, Chem. News, *105*, p. 205, 1912.

less readily in an oxidizing flame,[1] it appears to be impossible to anneal it perfectly and thus insure complete isotropy.

II. MEASUREMENTS OF THERMAL EXPANSION PRIOR TO 1911.

Le Chatlier,[2] in 1889, appears to have been the first to measure the approximate coefficient of expansion of fused silica. Curve I, (Fig. 1)[3] represents his results, the dilatations being expressed in μ per meter. His mean coefficient between 0° and 1,000°C. was $0 \cdot 7 \times 10^{-6}$. Curve II shows his results for the crystalline form of quartz parallel to the axis; Curve III, perpendicular to the axis; and Curve IV is for a quartzose sandstone. It will be seen that in the crystalline form the expansion is quite regular and much more rapid than that of the fused substance up to about 570°C., where a sudden expansion takes place which is followed by a steady contraction on further heating. It will also be noticed that Curve IV lies just above the mean position of Curves II and III.

The work of Le Chatlier, Boys, Shenstone and others had brought to the notice of physicists and chemists a substance whose many desirable properties and importance were quickly recognized. Many workers soon set about the more exact study of these properties which was necessary if fused silica were to be used to advantage in the carrying out of accurate work.

The results of the numerous investigators, who studied its thermal expansion during the first decade of the present century, have been so well summarized in an excellent paper by Dr. G. W. C. Kaye[4] that it has seemed sufficient for this period merely to mention the principal workers, with a brief statement of the more important results[5] which had been obtained at that time.

As was seen from Fig. 1, quartz in the crystalline state has a fairly large coefficient of expansion, while in the amorphous state its coefficient becomes very small. For example, the approximate values at moderate temperatures as given by Dr. Kaye are:—

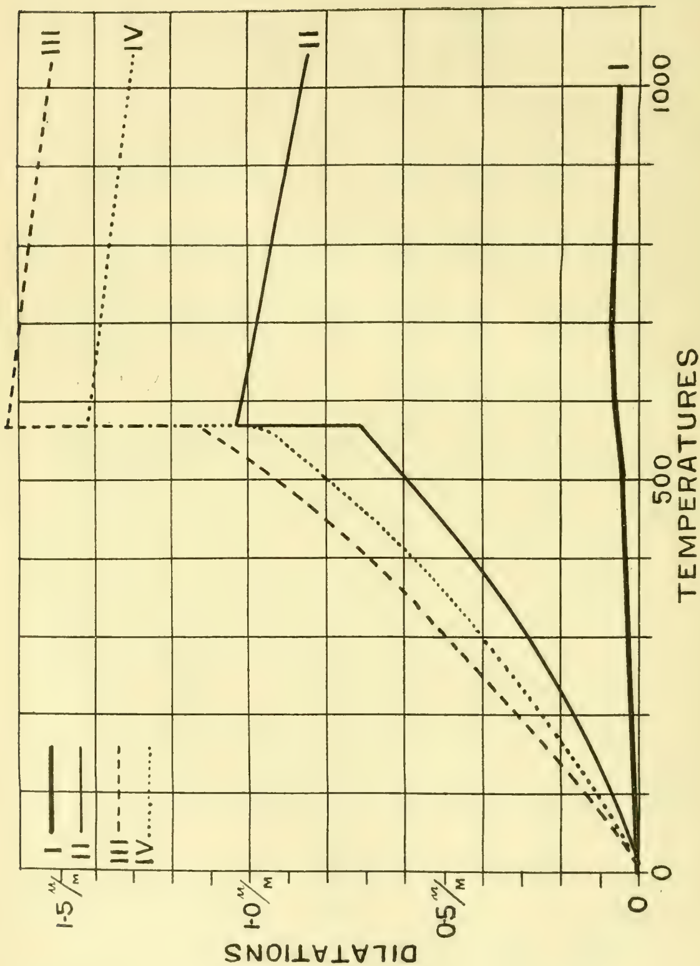
[1] Dufour, Loc. cit.

[2] Comptes Rendus *108*, pp. 1046-1049, 1889.
" " *130*, pp. 1703-1705, 1900.

[3] Fig. 1 is taken from Shenstone's paper as it appeared in Chem. News *83*, p. 206, 1901, and is due to Le Chatlier.

[4] Phil. Mag. (6) *20*, pp. 718-728, 1910.

[5] For a more complete account of the work of this period reference should be made to Dr. Kaye's paper, to which the writer begs to acknowledge his indebtedness, as well as to the original papers.



I
II
III
IV
0
500
1000
TEMPERATURES
DILATIONS
1·5 m/M
1·0 m/M
0·5 m/M
0

Fig. 1.

Crystalline quartz parallel to axis $7 \cdot 5 \times 10^{-6}$ [1]

" " perpendicular to axis $13 \cdot 5 \times 10^{-6}$

fused quartz, or fused silica $0 \cdot 4 \times 10^{-6}$

Owing to the extreme smallness of the expansion of the amorphous quartz, and also to the fact that small specimens were often more easily obtainable, most observers during this period adopted some modification of Fizeau's[2] interference method.

Dr. Kaye's summary of the work is shown graphically in Fig. II., which is reproduced from his paper, in which values of $(l_t - l_o)/l_o$ given by or deduced from the results of the various observers, are plotted against the temperature (t). At moderate temperatures, he quotes the work of Chappuis[3] (1903), of Scheel[4] (1903,1907) and of Randall[5] (1910); at low temperatures, that of Scheel[6] (1907) and Dorsey [7] (1907); and at high temperatures, that of Le Chatlier[8] (1900), Callendar [9] (1901), Holborn and Henning [10] (1903), Minchin [11] (1907), Randall [12] (1910). The combined results of these observers with the exception of those of Minchin, in whose work certain errors had been found, are shown in Fig . II. The excellent agreement of the results, especially over the range 0° to 1,000°C., is noticeable.

Dr. Kaye[1] makes some interesting remarks concerning the "change points" exhibited by the curve of Fig. 2. One of these points occurs at about 1,000°C. which is, as Dr. Kaye remarks, in agreement with the conclusion of Day and Shepard[2] that above about 1,000°C. fused silica devitrifies into crystalline tridymite which appears to be the stable phase above this temperature.

It might be noted that, in the light of more recent investigation, the dotted part of Dr. Kaye's curve does not appear to represent the truth. For example, in 1912 Callendar[3] describes a specimen of vitreous silica, which he examined, as having "a well-marked flat or change-point, in the curve near 1,000°C., above which the slope

[1] Benôit, Trav. et Mém. du Bur. Intl. I, 1881; Scheel, Ann. der Phys. *9*, pp. 837-853, 1902; Randall, Phys. Rev. *20*, pp. 10-37, 1905.

[2] Ann. der Chem. et des Phys. (4) *2*, pp. 143-185, 1864; Ibid (4) *8*, pp. 335-361, 1866. Comptes Rendus *58* pp. 923-932, 1864; Ibid *62*, pp. 1133-1148, 1866.

[3] Procés Verbaux, Intl. Comm. des Poids et Mesures, p. 75, 1903.

[4] Verh. d. D. Phys. Ges. *5*, pp. 119-123, 1903;
" " " " *9*, pp. 718-721, 1907.

[5] Phys. Rev. *30*, pp. 216-235, 1910.

[6] Verh. d. D. Phys. Ges. *9*, pp. 3-23, 718-721, 1907.

[7] Phys. Rev. *25*, pp. 88-102, 1907.

[8] Loc. cit.

[9] Chem. News *83*, pp. 151-152, 1901.

[10] Ann. der. Phys. 10, pp. 446-448, 1903.

[11] Phys. Rev. *24*, pp. 1-21, 1907.

[12] Loc.cit

[13] Loc. cit.

[14] Amer. Jour. Sci. (4) *22*, p. 298, 1906.

[15] Proc. Phys. Soc. London *24*, p. 195, 1912.

resumed its original value as far as 1,400°C. When maintained at a steady temperature in this region, the rod showed a continuous increase in length, accompanied by a marked superficial devitrification," etc.

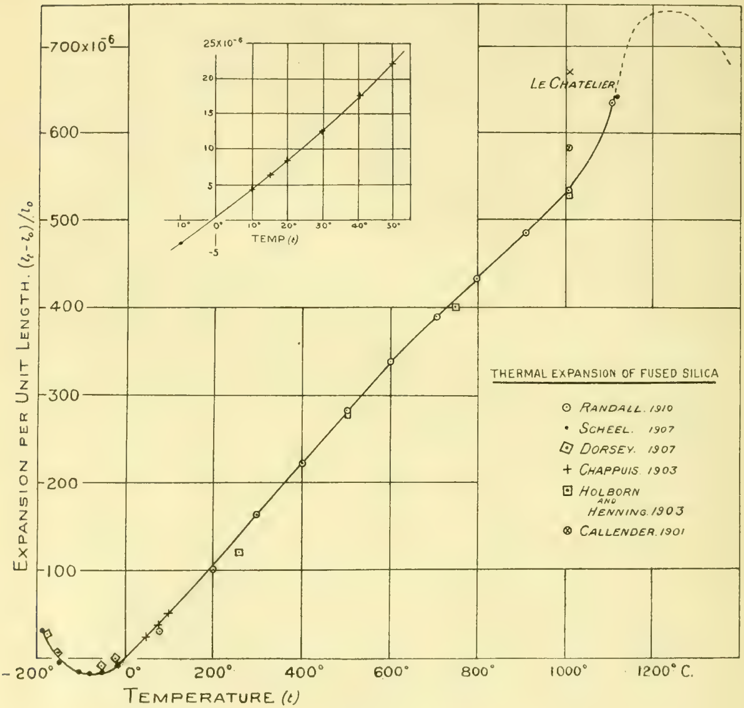


Fig. 2.

A second change point occurs near —80°C. at which point Scheel has noted a maximum density as well as a minimum length. Dorsey[1] noticed a peculiar phenomenon within a range of about 60° on either side of —80°C. Above this point of minimum length, the silica, when warmed, first contracts slightly , and then expands. For temperatures below —80°C. the converse is true.

There is some evidence of a third change-point in fused silica near 500°C. The expansion curve indicates a maximum value of

[1] Loc. cit.

the coefficient at this temperature. As the maximum length of crystalline quartz occurs near this temperature, it may be that the more rapid expansion of the fused quartz is due to the fact that the change from the crystalline form to the amorphous is not quite complete.

Recently Mr. A. Blackie[1] at the National Physical Laboratory has compared the expansions of translucent and of transparent fused silica. He finds that the translucent variety expands somewhat more rapidly up to 500°C. than the transparent. In other words, this maximum near 500°C. is more pronounced in the translucent than in the transparent fused silica, as would perhaps be expected if this maximum is due to the presence of a small amount of crystalline material in the fused quartz.

Dr. Kaye also notes that a well-marked recalescent point at about 500°C. has been observed for quartz crystals, while Rosenhain did not detect such a point in fused silica.

For moderate changes of temperature the thermal hysteresis, or residual variation of the expansion coefficient, is very small, although it has been definitely established and measured for a temperature range not exceeding 400 or 500°C. by Mr. L. F. Richardson[2] at the National Physical Laboratory. Following Dr. Kaye, we take $\frac{\partial l}{l} \cdot \frac{1}{t}$ as the definition of the thermal hysteresis, where l is the length of the specimen at 0°C. and ∂l is the increase in length *at 0°* produced by heating to a temperature t° and maintaining it at this temperature for a considerable time, and then allowing it to cool to zero.

For annealed specimens of fused silica, Richardson obtained the following values; over the range —190 to 400°C. between -1×10^{-9} and -5×10^{-9}, and over the range 0 to 800° about -17×10^{-9}, while over the range 0 to temperatures above 1,000°C. a positive value was obtained. The negative value of course indicates that the contraction during cooling is greater than the expansion during the preceding heating.

III. RELATION BETWEEN LINEAR AND CUBICAL EXPANSION.

In January, 1911, there appeared a detailed account of the measurement of the absolute expansion of mercury by Callendar and Moss[3] by means of an elaboration of Dulong and Petit's method

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[1] Chem. News *104*, pp. 77-79, 86-88, 1911, Faraday Soc. Trans. *8*, part I, 1911; Nat. Phys. Lab. Call. Res. *8*, pp. 139-151, 1912.

[2] Phil. Mag. (6) *20*, pp. 726-727, 1910.

[3] Phil. Trans. A. *211*, pp. 1-32, 1911; Proc. Roy. Soc. London, *A*. *84*, pp. 595-597.

of equilibrating columns as modified by Regnault. As they claimed a high degree of accuracy for their results, the way appeared open for the direct determination of the cubical expansion of fused silica by the use of a mercury-in-quartz dilatometer.

Accordingly, at the suggestion of Callendar, Mr. F. J. Harlow[1] undertook the direct measurement of the cubical expansion of silica by the dilatometer or weight thermometer method. He measured the apparent expansion of mercury, and assuming the values of Callendar and Moss for the absolute expansion of mercury, calculated the coefficient of cubical expansion of his silica bulbs, from the formula,

$$a = \frac{m}{M_t} + \frac{M_t + m}{M_t} g,^2$$

where a = the absolute coefficient of expansion of mercury,
m = overflow,
M_t = Mass of mercury in dilatometer at t°C.,
g = coefficient of cubical expansion of the silica dilatometer.

The mean values of the coefficient of cubical expansion of fused silica obtained by Harlow were—

between0° and 100°C., $0 \cdot 998 \times 10^{-6}$,
and " 0° " 184°C.,$1 \cdot 447 \times 10^{-6}$;

while the values obtained by taking there times the linear coefficient as given by Kaye's mean curves are—

between 0° and100°C., $1 \cdot 49 \times 10^{-6}$,
and " 0° " 184°C., $1 \cdot 54 \times 10^{-6}$.

Harlow used three different transparent fused silica dilatometers. The first was of the ordinary type and was filled by the usual method of alternate heating and cooling, with the open end under mercury. As a larger value of the apparent coefficient of expansion of mercury

[1] Proc. Phys. Soc. London, *24*, pp. 30-39, 1911; Chem. News, *104*, p. 289, 1911; Nature 88, p. 234, 1911.

[2] This equation is easily deducible as follows:—

Let V_0 = volume of mercury and of dilatometer at 0°C.
and V'_t = " " dilatometer at t°C.

Then denoting the density of mercury at 0° and t°C. by ρ_o and ρ_t respectively, we have—

$$V_t = V_o (1 + gt) \text{———} (1)$$
$$\rho_o = \rho_t (1 + at) \text{———} (2)$$

Also we can write, $V'_t \rho_t = M_t$ ——(3)

$$V_o \rho_o = M_t + m \quad (4)$$

Dividing (4) by (3) and making use of (1) and (2) we obtain

$$\frac{1 + at}{1 + gt} = \frac{M_t + m}{M_t}$$

whence, solving for a, one obtains the above equation. When t is negative, m will also be negative, and the formula still holds.

than was expected was obtained, measurements were taken with a second dilatometer so designed as to be easily filled under a vacuum in order to exclude the possibility of the presence of any air bubbles in the bulb. Finally, a third form of bulb, containing concentric silica tubes sealed inside to test for the possible existence of some surface effect, was employed. The close agreement between the results obtained with the three dilatometers indicated conclusively that the unexpectedly low value obtained was not due to either of these causes.

Harlow observed no permanent change in the volume of the bulbs through repeated heatings to 184°C., as indicated by the ice-point readings.

The effect of change of pressure and of the change in the elastic constants of silica, due to change of temperature, was shown to be negligible.

Consequently, in view of the fact that the value of the linear coefficient of expansion changes sign at about —80°C., Harlow was led to conclude that the mean value of the linear coefficient as given by Kaye was too high, especially for the range 0° to 100°C.

In the discussions which followed the presentation of Harlow's paper to the London Physical Society, Callendar expressed the conviction that the cubical expansion could not be deduced from the linear because of the impossibility of properly annealing a silica bulb, owing to rapid devitrification at 1,000°C.

As Scheel[1] pointed out, in a summary of the measurements which had up to that time been made on the thermal expansion of quartz glass, had Harlow used the mean of the coefficient of expansion of mercury between 0° and 100°C. obtained by the use of dilatometers of *verre dur* by Chappuis[2] and by Thiesan, Scheel and Sell,[3] i.e., $182 \cdot 57 \times 10^{-6}$, he would have obtained $1 \cdot 52 \times 10^{-6}$ as the coefficient of cubical expansion of fused silica, a value in good agreement with that calculated from the linear expansion.

In view of the possibility of the existence of some undetected error in the measurements of the linear coefficient by the interference method, as suggested by Harlow's work, Mr. H. Donaldson[4] of the National Physical Laboratory made a determination of the coefficient of linear expansion of the standard fused silica meter, which is in the

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[1] ZS. f. Instrkde *32*, pp. 14-18, 1912.

[2] Trav. et Mim. du Bureau Intl. des Poids et Mesures *13* C., p. 31, 1903.

[3] Wissensch Abhandl. d. Phys.-Techn. Reichsanstalt *4*, p. 4, 1904.

[4] Proc. Phys. Soc. London *24*, pp. 186-194, 1912; Chem. News *105*, p. 178, 1912; Nat. Phys. Lab. Coll. Res. *9*, pp. 181-190, 1913.

form of a transparent silica tube[1] a meter long, by the comparator method. The fact that his results agree very closely with the values obtained by the interference method, removes any serious doubt as to the approximate value of the linear coefficient for silica.

About a year after the appearance of Callendar and Moss's paper, on the absolute expansion of mercury, Scheel and Heuse[2] published a criticism of their results. Table I., taken from their paper,

Table I.

Temperature.	Mean Value.	Variations from the Mean Value × 10^6.					
		Chappius direct.	Chappius indirect.	Thiesen, Scheel, and Sell.			Callendar and Moss.
				16^{III}.	59^{III}.	Absolute Thiesen.	
0.....	1·000 000	0	0	(0)	(0)	0	0
10.....	1·001 817	0	−1	(0)	0	..	−10
20.....	1·003 634	0	−2	(0)	+2	..	−18
30.....	1·005 453	−2	−2	(+ 1)	+3	..	−24
40.....	1·007 273	−3	−2	(+ 1)	+6	..	-29
100.....	1·018 257	−3	..	(−25)	−1	+3	-52

shows the variation of the different results for the expansion of mercury from the mean of the values obtained by Chappuis and by Thiesan, Scheel and Sell.

Callendar and Moss had raised the objection against Chappuis' values, that it is not allowable to calculate the cubical expansion from the linear. Scheel and Heuse urged in favor of Chappuis' result the fact that not only had he measured the axial expansion of the actual *verre dur* dilatometer bulb used (which was one meter in length and 4 cms. in diameter), but that he had used the same *verre dur* bulb and also one of platinum-iridium to measure the expansion of water, with practically identical results. As Scheel and Heuse said, it was not likely that the two substances would be to the same extent aeolotropic. In conclusion they referred to Harlow's determination of the cubical expansion of mercury by the weight thermometer method, and urged that Harlow's observations were in accord with Chappuis' value, and did "not force the assumption of the aeolotropy of fused silica, but on the other hand" indicated "the presence of error in the measurements of Callendar and Moss."

[1] Proc. Roy. Soc. A. *85*, pp. 430-447, 1911; Nat. Phys. Lab. Coll. Res. *8*, pp. 87-105, 1912.

[2] Phil. Mag. (6) *23*, pp.412-417, 1912; Verh. d. D. Phys. Ges. *14*, pp. 139-144, 1912.

Soon after, there appeared an article by N. Eumorfopoulos[1] in which he took the view with Scheel and Heuse that the values of Callender and Moss for the expansion of mercury were too low, especially below 100°C. He had determined the cubical expansion of the bulb of a fused silica weight thermometer. His results for the cubical expansion, which were obtained from the apparent expansion observed and the values of the absolute expansion of mercury as given by various observers, are shown in Fig. III. (which is taken from Eumorfopoulos' paper), curves I.-III. Eumorfopoulos concludes that Callendar and Moss's values for the expansion of mercury lead to inadmissable values for cubical expansion of fused silica at low temperatures.

Curves IV, and V, obtained from Scheel's value for the linear expansion of two different specimens of fused quartz, led Eumorfopoulos to conclude that for accurate work it was unsafe to apply results obtained from one specimen of silica to another. While this discrepancy between the values for the cubical expansion of mercury corresponds to a difference of 50% or more between the axial and radial expansions of silica, it would be explained, as Callendar[2] points out in his reply to the criticism of Scheel and Heuse, by a difference of only 2% in the case of *verre dur*. In a paper which soon appeared, Callendar[3] described an experiment in which the axial and radial expansions of a quartz tube, obtained from the Silica Syndicate who had supplied the bulbs used by Harlow and Eumorfopoulos, were directly compared by the interference method. The axial coefficient between 0° and 100°C. was found to exceed the radial by $\cdot 20 \times 10^{-6}$. Assuming, as Callendar did, $\cdot 465 \times 10^{-6}$ as the axial coefficient, the cubical coefficient comes out to be $\cdot 995 \times 10^{-6}$,—a result in entire agreement with Harlow's experimental value.

Thus, to quote from Callendar, "The principal objection advanced by Eumorfopoulos against the results of Callendar and Moss, at low temperatures where the observations are admittedly more difficult, appears to be that, according to his weight thermometer, the cubical expansion of silica would vanish between 0° and 15°C. This apparently impossible result is confirmed by the observations with the ring and tripod, which show that the difference between the axial and radial coefficients increases, while the axial coefficient diminishes more rapidly at low temperatures."

Had the matter ended here, we might have been content to accept Harlow's lower value for the cubical expansion of fused quartz

[1] Phil. Mag. (6) *23*, pp. 653-655, 1912.

[2] Phil. Mag. (6) *23*, pp. 679-683, 1912.

[3] Phil. Mag. (6) *23*, pp. 998-1000, 1912; ZS. f. Instrkde *32*, pp. 194-195, 1912.

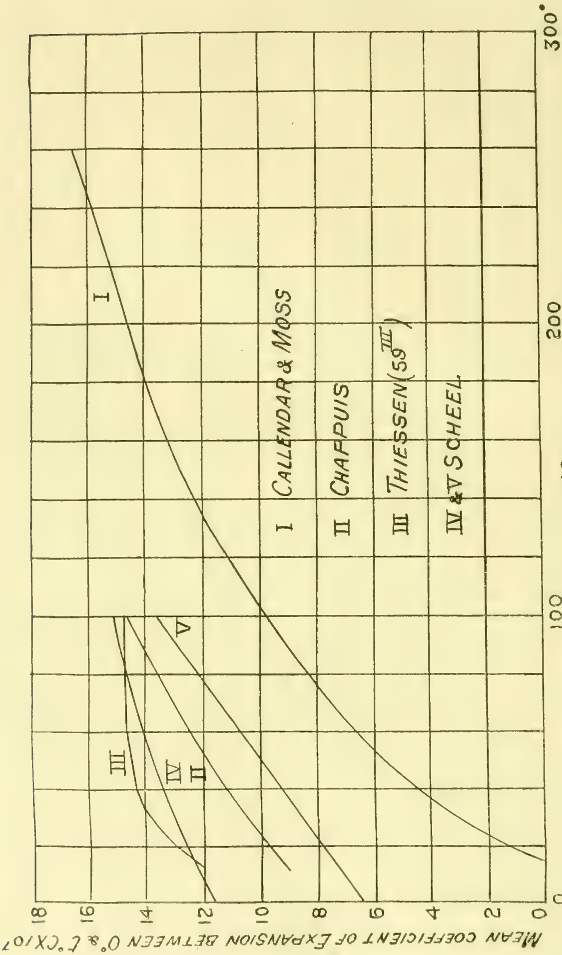
I CALLENDAR & MOSS
II CHAPPUIS
III THIESSEN (59 III)
IV & V SCHEEL
I
II
III
IV
V
0
100
200
300°
t °C
0
2
4
6
8
10
12
14
16
18
MEAN COEFFICIENT OF EXPANSION BETWEEN 0° & t°C X10^7

Fig. 3.

and have concluded that Callendar and Moss had corrected a long-standing error in the absolute expansion of mercury between 0° and 100°C. of nearly 0·3%. However, the reports of more recent investigations of Callendar[1] and Harlow,[2] communicated to the London Physical Society in November, 1913, throw considerable doubt on the conclusion that the cubical expansion of a fused quartz dilatometer bulb between 0° and 100°C. is only twice the axial, and that it vanishes between 0° and 15°C.

The more recent conclusions of Callendar may in part be summed up as follows:—

(1) That in attempting to deduce the expansion of mercury by the weight thermometer method with silica bulbs, it was necessary to determine the expansion of specimens of silica from the same source over the entire range 0° to 300°C.,

(2) That, although differences of 5 or 10 per cent in the expansion in different directions appeared persistent,—and were not removed by heating to 1,000°C. or cooling to the temperature of liquid air,—the most probable result for the cubical coefficient would be obtained by assuming it to be three times the linear;

(3) That owing to the smallness of the expansion of silica, and its comparative freedom from hysteresis, the possible uncertainty with silica bulbs, in the expansion of mercury, was probably less than 0·1 per cent in spite of imperfect annealing.

Over the range 20° to 300°C., Callendar's recent results for the linear expansion of fused silica are represented by the equation:—

$$ {}_0a_t = \left\{ \cdot 78 - \frac{86 \cdot 5}{t+175} \right\} 10^{-6} $$

where ${}_0a_t$ is the mean coefficient between 0° and t°C.

Harlow's recent paper[3] contains a more complete set of observations of the relative coefficient of expansion of mercury in silica, than his earlier paper. Some readings taken with a spherical bulb failed to support the earlier conclusion that the cylindrical bulbs were not isotropic.

Using Callendar's recent value for coefficient of expansion of silica determined for specimens similar to those from which the bulbs were made and assuming the cubical expansion to be three times the linear, the absolute expansion of mercury was determined (See table

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[1] Nature *92*, p. 467, 1913.

[2] Proc. Phys. Soc. London *26*, pp. 85-96, 1914; Nature *92*, p. 467, 1913.

[3] Loc. cit.

II., column 3)[2], and found to be in fairly good agreement with Chappuis' values.

Harlow concludes his paper as follows:—

"The large discrepancy which exists between the results of the absolute and weight thermometer methods, at the lower temperatures, is difficult to explain. It seems that there must be some hitherto undiscovered systematic error in one of the methods, and in view of the importance of a knowledge of the correct thermal expansion of mercury in thermometry of precision, the subject undoubtedly calls for further investigation."

In the discussion which followed, Mr. Sears called attention to the values of the coefficient of mercury obtained by certain observers (See Table II.) He thought it on the whole fairer, as Callendar's

Table II.

Temperature range.	1	2	3	4	5	6
	Chappuis, 1907.	Callendar and Moss, 1911.	Harlow, 1913.		Donaldson, 1912 (cubic).	Sears (Quartic)
			(Callender, silica).	(Kaye, silica).		
0°C.– 30°C.	18,171	18,095	18,168	18,187	18,170	18,174
0°C.– 50°C.	18,183	18,124	18,188	18,201	18,192	18,194
0°C.– 75°C.	18,211	18,163	18,213	18,223	18,222	18,221
0°C.–100°C.	18,254	18,205	18,244	18,251	18,254	18,251
0°C.–140°C.	..	18,280	18,305	18,305	18,311	18,306
0°C.–184°C.	..	18,371	18,387	18,380	18,380	18,379
0°C.–200°C.	..	18,406	18,419	18,410	18,407	18,410
0°C.–250°C.	..	18,525	18,537	18,523	18,497	18,522
0°C.–300°C.	..	18,657	18,678	18,660	18,597	18,663

$\times 10^{-8}$

and Eagle's[1] experiments were not made on the actual bulbs used by Harlow and also were very near Kaye's mean values, to use the mean of the two. Accordingly, he had calculated a quartic representing the expansion of mercury on this basis (See Table II., column 6.)

Mr. Sears thought that "Prof. Callendar would presumably agree that, pending some further investigation, the Callendar-Moss values at the lower temperatures, must be regarded as being affected by some unexplained source of experimental error."

[2] Table II is taken from the report of the discussion of Harlow's paper and is due to Mr. Sears.

[1] Mr. A. Eagle has recently measured the expansion of fused silica over the range 0° to 120°C. His results which have not yet come to hand, are in close agreement with Callendar. (See Proc. Phys. Soc. London *26*, p. 92.)

The recent work of C. B. James[1] at the Macdonald Physics Building, McGill University, on the expansion of mercury at low temperatures by the silica dilatometer method, is in accord with the more recent view of Callendar that the cubical expansion of a fused silica bulb may be calculated from the linear expansion and cannot be neglected at low temperatures.

IV. THE MOST PROBABLE MEAN VALUE OF THE LINEAR EXPANSION.

Since it appears that the cubical expansion of fused silica may be calculated very approximately from the linear, an accurate knowledge of the latter is of interest to those using dilatometers and other forms of apparatus constructed of fused silica. Accordingly, the averages of what appear to be the most accurate determinations have been arranged in convenient form for reference.

Following the method adopted by Mr. Kaye in 1910, the values of $(l_t - l_o)/l_o$, (where l_t is the length at t°C. and l_o that at 0°C.) obtained from the results of various observers, have been arranged in Tables III, IV, and V. In the tables, the means of the values given appear in the last column.

In addition to results already referred to, those of Scheel and Heuse[2] published in January, 1914, are included. The values which they obtained between —253° and 100°C. are represented by the formula:—

$$l_t = l_o\,[1 + \cdot 362\ t + \cdot 001813\ t^2 - \cdot 00000340\ t^3]\ 10^{-6}.$$

TABLE III.

Temp. (t).	$(l_t - l_o)/l_o \times 10^6$					
	1	2	3	4	5	6
	Chappuis 1903.	Scheel 1903.	Scheel 1907.	Callendar 1913.	Scheel and Heuse 1914.	Means.
10°C.	4·0	3·4	4·0	3·1	3·8	3·7
20	8·2	7·0	6·6	6·7	7·9	7·6
50	22·	20·	23·	19·8	22·2	21·4
80	38·	35·	39·	35·3	38·8	37·2
100	50·	47·	50·	46·4	50·9	48·9

[1] Trans. Roy. Soc. of Canada, Sec. III (3) 8, pp. 51-58. 1914.

[2] Verh. d. D. Phys. Ges. *16*, pp. 1-3, 1914.

TABLE IV.

Temp. (t).	$(l_t-l_o)/l_o \times 10^6$			
	1	2	3	4
	Scheel [1] 1907.	Dorsey 1907.	Scheel and Heuse 1914.	Means.
− 10°C.	− 3·7	− 3·2	− 3·4	− 3·4
− 20	− 7·0	− 6·1	− 6·5	− 6·5
− 50	−14·6	−12·9	−13·1	−13·5
− 80	−17·7	−14·7	−15·6	−16·0
−100	−14·9	−13·4	−14·7	−14·3
−150	− 3·4	+ 4·0	− 2·0	− 0·5
−190	+21·6	......	+20·0	+20·8
−220	......	......	+44·3	+44·3
−250	......	......	+75·9	+75·9

[1] Zeiss specimen.

TABLE V.

Temp. (t).	$(l_t-l_o)/l_o \times 10^6$			
	1	2	3	4
	Holborn and Henning 1903.	Randall 1910	Callender 1913	Means.
150°C.	....	....	77·1	77·1
200	....	100	109·9	105
250	118	....	144·1	131
300	....	161	179·4	170
400	....	222	....	222
500	276	281	....	279
600	....	336	....	336
700	....	389	....	389
750	403	....	....	403
800	....	434	....	434
900	....	481	....	481
1,000	537	541	....	539
1,100	....	641	....	641

Columns 1-3, Table III and columns 1-2 of Tables IV and V are taken from Dr. Kaye's paper. The other results were obtained by calculation from the formulæ given above.

It will be noticed especially at lower temperatures that the individual results are in fairly good agreement with the mean values. Above 1,000°C., the results are probably too high.

The mean results, thus obtained, nearly all fit an even curve very well as shown by Fig. IV. The values of l_t/l_o^1, obtained from the curve of Fig. IV, plotted on a much larger scale, have been tabulated for every ten degrees from —250° to 1,100°C. (See Table VI.)

To find the average coefficient of expansion over any required temperature range, it is only necessary to subtract the value of l_t/l_o for the lower temperature from that at the higher temperature and then divide by the temperature difference. Thus to find the coefficient of expansion between $-40°$ and 100°C., we would subtract $0 \cdot 9999884$ from $1 \cdot 0000488$ and divide by 140, obtaining $0 \cdot 431 \times 10^{-6}$. By interpolation, values for temperatures which are not exact multiples often may be found.

The absolute value of the thermal expansion of fused quartz is so small that often its knowledge is not required to a high degree of accuracy. In spite of the differences which appear to exist between different specimens of fused quartz, it is thought that, over a range of 100°C. or more (below 1,000°C.), Table VI. can be relied upon to give the linear or cubical expansion coefficient of an average specimen of fused quartz, at least to an accuracy of within 4 or 5 per cent, which corresponds to an accuracy in absolute expansion of about 0·3 per cent for *verre dur.*

In the light of the above evidence, it would seem that, where a much greater accuracy is required, it is necessary to determine the expansion of the actual silica dilatometer bulb or apparatus used. Indeed where very great accuracy is required, it would seem desirable to determine the linear expansion in more than one direction when possible.

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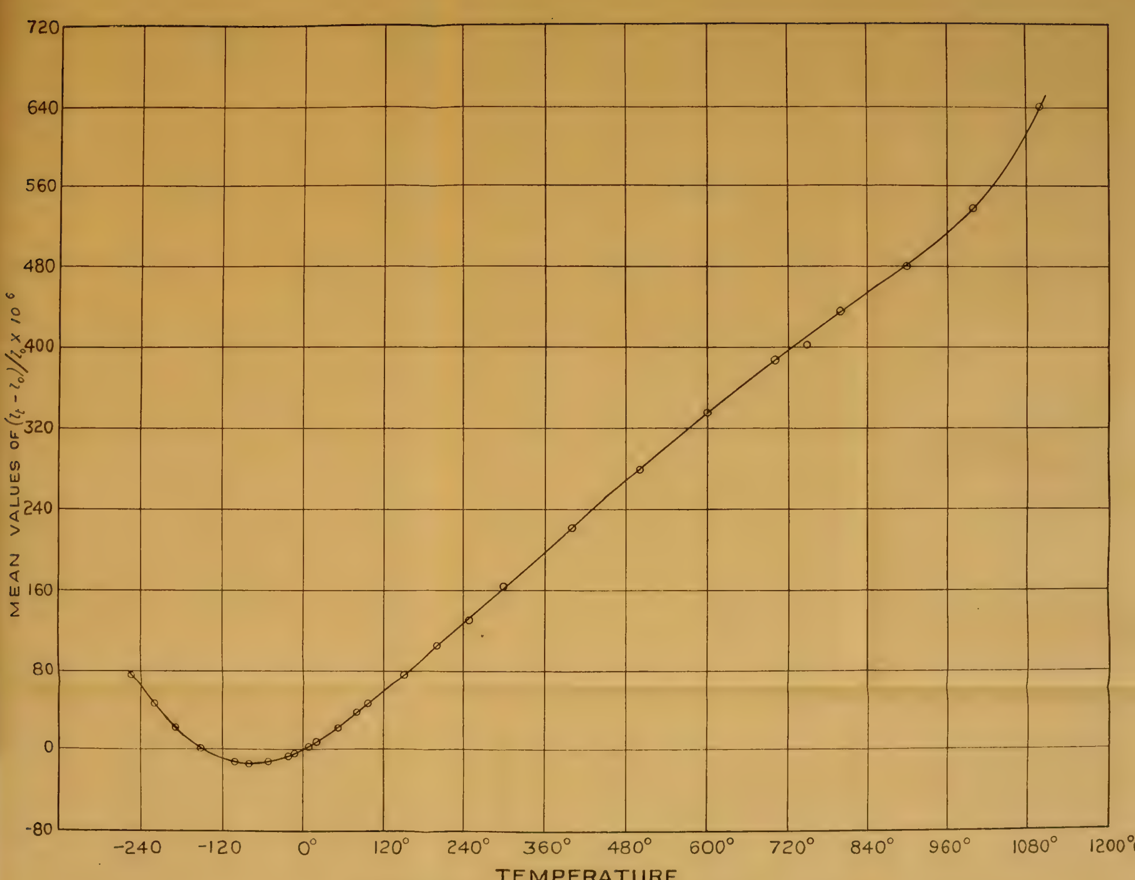
[1] $l_t/l_o = (l_t - l_o)/l_o + 1.$

TABLE VI.

EXPANSION OF QUARTZ GLASS OR FUSED SILICA.

Temperature.	Average value of l_t/l_o from $-250°$ to $1,100°$ C.											Temperature.
t°C.	0		10	20	30	40	50	60	70	80	90	t°C.
−300	1·0000	xxx	xxx	xxx	xxx	xxx	759	644	539	443	356	−300
−200	1·0000	278	208	146	091	043	000	$\overline{961}$	$\overline{927}$	$\overline{898}$	$\overline{874}$	−200
−100	0·9999	857	845	840	842	851	865	884	908	935	966	−100
0	1·0000	000	037	077	120	166	214	265	318	374	431	0
100	1·0000	488	545	602	659	716	772	828	883	939	996	100
200	1·0001	05	11	17	23	29	35	41	48	54	60	200
300	1·0001	66	72	78	84	90	95	$\overline{01}$	$\overline{06}$	$\overline{12}$	$\overline{17}$	300
400	1·0002	22	28	34	39	45	51	56	62	68	74	400
500	1·0002	79	85	90	96	$\overline{02}$	$\overline{07}$	$\overline{13}$	$\overline{19}$.	$\overline{24}$	$\overline{30}$	500
600	1·0003	36	42	47	53	58	63	69	74	79	84	600
700	1·0003	89	94	98	$\overline{03}$	$\overline{07}$	$\overline{12}$	$\overline{16}$	$\overline{21}$	$\overline{25}$	$\overline{29}$	700
800	1·0004	34	39	43	48	52	57	62	66	71	76	800
900	1·0004	81	86	91	96	$\overline{01}$	$\overline{07}$	$\overline{13}$	$\overline{19}$	$\overline{25}$	$\overline{32}$	900
1,000	1·0005	39	46	54	63	72	82	93	$\overline{04}$	$\overline{16}$	$\overline{28}$	1,000



THERMAL EXPANSION OF FUSED SILICA.

Fig. 4.

Transactions of The Royal Society of Canada
SECTION III

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The Spectroscopic Binary θ^2 Tauri.

By Dr. J. S. PLASKETT, F.R.S.C.

The Star θ^2 Tauri α, 4h 22m·9, δ, + 15° 39′, magnitude 3·6, spectral type A5, was announced as a spectroscopic binary by Moore in the Lick Observatory Bulletin No. 62 and by Frost in the Astrophysical Journal XXIX p. 238.

The published velocities from these observatories with the date, Julian day, phase, and residual, the two latter being obtained from the elements finally accepted, are given at the beginning of the table of measures below.

The star was placed under observation here on Dec. 11, 1909 and 66 plates were obtained between that date and March 1912 of which 52 were selected for measurement. From these measures preliminary elements were obtained and presented to the Society under the above title at the May meeting 1912. This was not published in the Transactions owing to its preliminary character, although a short account of the work to date was given in the Journal R.A.S.C., VI, p. 231, July-August 1912. A summary of this is given below but, owing to uncertainty in some of the results obtained, further observations were considered desirable. Hence 16 more plates were obtained making a total of 68 plates on which the present determination is based.

The spectrum is of type A5 containing numerous metallic lines, but unfortunately all these lines are wide and diffuse, making the measurements more or less uncertain. This is shown by the poor agreement often present between different lines on the same plate and by the comparatively high probable error ±3·6 km. per second of a single plate derived from the plate residuals from the final orbit. Four different dispersions were tried in the hope of getting more satisfactory measures with this type of spectrum, but no one showed very marked advantages over the others. This will be discussed more fully later.

The principal lines measured—all those used in the measures—with their chosen wave lengths and source are given in the accom-

panying list. The titanium lines seem in general to be the best defined and most reliable in this spectrum.

Lines Measured in θ^2 Tauri.

Wave length	Element	Wave length	Element
4584·018	Fe.	4455·116	Blend.
4572·156	Ti.	4415·293	Fe.
4563·939	Ti.	4404·927	Fe.
4549·766	Ti-Fi.	4399·935	Ti-Cr.
4534·139	Ti.	4395·201	Ti.
4515·508	Ti.	4374·520	Blend.
4508·455	Ti.	4351·930	Cr.
4501·488	Ti.	4340·634	H.
4494·738	Fe.	4325·939	Fe.
4481·400	Mg.	4315·138	Fe.
4468·663	Ti.	4290·377	Ti.

The summary of the measures of the early plates at the Lick and Yerkes Observatories, of the 52 plates used in the first determination, and of the 16 plates obtained subsequently, with other data are given in the accompanying table.

SUMMARY OF MEASURES.

Plate	G.M.T.	Julian Date	Spectrograph	Phase	Velocity	Residual O.-C.	Remarks
Lick Plates	Dec. 1, 1903	2,416,450·70		139·10	+38	− 2·8	
	Jan. 3, 1905	6,849·60		115·90	+50	+13·9	
	Oct. 4, 1906	7,488·65		51·45	+74	− 7·8	
	Sep. 8, 1908	8,193·90		53·20	+80	+ 0·6	
	Oct. 21 "	8,236·85		96·15	+17	−14·8	
	Oct. 25 "	8,240·85		100·15	+23	− 9·7	
Yerkes Plates	Aug. 31, 1906	7,454·88		17·68	+42	− 5·9	
	Nov. 4, 1907	884·77		25·47	+29	−22·4	
	Aug. 25, 1908	8,179·94		39·24	+64	+ 2·6	
	Sep. 8 "	193·95		53·25	+88	+ 9·0	Secondary +40
	Sep. 18 "	203·85		63·15	+10	−18·7	
	Oct. 12 "	227·85		87·15	+39	+ 9·9	Secondary +8.
	Nov. 8 "	254·78		114·08	+36	+ 0·3	
	Dec. 7 "	283·63		2·23	+38	− 6·0	
	Dec. 11 "	287·63		6·23	+31	−13·0	
Ottawa							
3030	Dec. 11, 1909	8,652·73	III S	89·93	+28·2	− 2·3	
3041	16	657·74	"	94·94	+30·9	− 0·6	
3044	18	659·66	"	96·86	+34·7	+ 2·7	
3056	28	669·78	"	106·98	+34·9	+ 0·8	
3068	30	671·51	"	108·71	+22·8	−11·7	
3076	30	671·65	I	108·85	+22·1	−12·4	
3085	Jan. 7, 1910	679·52	III S	116·72	+31·4	− 4·8	
3108	14	686·66	"	123·86	+29·2	− 8·6	
3116	15	687·53	"	124·73	+38·9	+ 0·8	
3133	19	691·56	"	128·76	+37·4	− 1·6	
3169	Feb. 3	706·70	"	3·20	+46·0	+ 2·9	
3201	21	724·55	I	21·05	+42·6	− 5·6	
3208	23	726·55	"	23·05	+57·0	+ 6·8	
3222	24	727·56	III S	24·06	+46·7	− 4·0	

Plate	Date	Julian Date	Spectro-graph	Phase	Velocity	Residual	Remarks
3255	Mar. 2, 1910	2,418,733·63	I	30·13	+60·6	+ 6·5	
3268	3	734·59	III R.	31·09	+54·0	− 0·7	
3308	10	741·61	"	38·11	+58·6	− 1·6	
3334	17	748·55	"	45·05	+71·8	+·2·5	Pr+107, Sec.+43
3623	Sep. 7	922·89	I	78·69	+31·9	+ 3·9	
3651	14	929·86	"	85·66	+37·3	+ 7·7	
3658	15	930·87	"	86·67	+42·5	+12·8	
3668	16	931·79	"	87·59	+27·3	− 2·7	
3687	21	936·88	"	92·68	+36·0	+ 5·0	
3730	Oct. 10	955·90	"	111·70	+25·8	− 9·3	
3741	12	957·88	"	113·68	+37·6	+ 2·0	
3784	31	976·73	"	132·53	+38·7	− 1·3	
3793	Nov. 2	978·82	"	134·62	+37·8	− 2·7	
3802	8	984·81	"	140·61	+44·3	+ 2·3	
3818	Dec. 5	9,011·67	"	26·77	+56·7	+ 4·6	Pr+112, Sec+11
3843	9	015·67	"	30·77	+56·2	+ 1·7	Pr+112, Sec.−37
3859	12	018·60	"	33·70	+61·2	+ 4·6	
3871	15	021·65	"	36·75	+55·1	− 3·9	
3888	21	027·66	"	42·76	+67·0	+ 1·4	
3916	Jan. 5, 1911	042·57	"	57·67	+42·7	− 1·4	
3922	9	046·61	"	61·71	+27·0	− 3·4	
3930	12	049·61	"	64·71	+32·3	+ 4·6	
3938	16	053·67	"	68·77	+25·8	− 1·0	
3958	18	055·59	"	70·69	+28·0	+ 1·0	
3970	30	067·59	III L	82·69	+35·1	+ 6·1	
4627	Oct. 10	320·79	I	54·49	+70·7	− 1·3	
4636	12	322·86	"	56·56	+62·1	+10·0	
4672	28	338·75	III L	72·45	+26·9	− 0·2	
4716	Dec. 6	377·77	I	111·47	+34·2	− 0·9	
4733	19	390·82	III L	124·52	+26·7	−11·3	
4739	25	396·75	I	130·45	+35·4	− 4·1	
4746	Jan. 1, 1912	2,419,403·71	III L	137·41	—	—	Pr+54, Sec+2
4760	10	412·63	"	5·63	+41·4	− 2·4	
4780	12	414·67	I	7·67	+45·3	+ 0·9	
4788	13	415·50	III L	8·50	+39·1	− 5·6	
4792	16	418·60	I	11·60	+40·7	− 5·0	
4832	Feb. 10	443·66	"	36·66	+60·9	+ 2·0	
4835	12	445·65	"	38·65	+58·9	− 1·8	
4880	Mar. 11	473·52	"	66·52	+25·8	− 1·4	
5218	Oct. 4	680·78	"	133·08	+41·6	+ 1·5	
5236	7	683·79	"	136·09	+48·7	+ 7·8	
5243	16	692·80	"	4·40	+50·8	+ 7·3	
5244	16	692·85	"	4·45	+44·4	+ 0·9	
5250	17	693·82	"	5·42	+41·4	− 2·3	
5251	17	693·85	"	5·45	+48·0	+ 4·3	
5253	20	696·64	"	8·24	+45·5	+ 0·9	
5254	20	696·69	"	8·29	+46·9	+ 2·3	
5259	25	701·71	"	13·31	+56·7	+10·0	
5260	25	701·75	"	13·35	+43·9	− 2·8	
5892	Jan. 21, 1914	2,420,154·56	"	44·06	+63·4	− 4·6	
5902	25	158·55	III L	48·05	+74·2	− 0·7	
5903	30	163·62	"	53·12	+76·1	− 3·2	
5904	Feb. 2	166·53	"	56·03	+63·2	+ 6·2	
5905	4	168·50	"	58·00	+37·6	− 4·4	
5914	5	169·60	I	59·10	+33·4	− 3·9	

A summary of the previous work on the orbit which has considerable bearing on this later determination will now be given. It was found necessary to carry through three least squares solutions of the orbit. In the first one of these a correction for the period was introduced; but when this correction was carried forward to the Lick and Yerkes observations it was found to be quite inapplicable and consequently the period was determined as closely as possible from a comparison of the early with the Ottawa values and the coefficient for this correction omitted from the later solutions.

The second solution resulted in such a large increase of K and consequent rise of the positive maximum velocity above any observed values as again to be inadmissible. This was undoubtedly due to the absence of any Ottawa observations near the peak of the curve which of course was very sharp with the high eccentricity of about 0·7. For the third solution therefore one Lick observation of + 80 km and one Yerkes of + 88 km, taken on the same day Sept. 8, 1908 very near the maximum, were combined into an additional normal place and incorporated into the observation equations, and the resulting solution was satisfactory. These different solutions are given here:

Element	1st Prel.	1st Solution.	2nd Prel.	2nd Solution	3rd Prel.	3rd Solution Ottawa obs. only	3rd Solution with Lick and Yerkes obs. added
Period	141·0	141·487	140·50	140·50	140·50	140·50	140·50
e	0·65	0·699	0·65	0·758	0·70	0·772	0·694
K	25·0	26·59	27·0	33·76	32·0	37·99	29·128
ω	45°·0	47°·43	50°·0	39°·09	45°·0	38·22	48°·57
T	51·0	51·075	56·33	54·876	55·74	55·207	56·12
γ	+41·51	+42·17	+42·72	+43·60	+43·16	+43·713	+42·90
Max. Vel.	+78·0	+81·34	+81·0	+97·22	+91·0	+104·7	+85·40
Min. Vel.	+28·0	+28·16	+27·0	+29·70	+27·0	+28·7	+27·14

The curious behaviour of these elements in the successive solutions is due to the preliminary elements in each case being not sufficiently close approximations to allow the second order differentials to be neglected, and also to the fact, and this also influenced the choice of the preliminary values, that there were no observations near the peak of the curve while the others were so situated as to abnormally influence the least squares solutions.

However it was not felt desirable as was done in the third solution to combine the Ottawa measures with those from other observatories, especially in view of the high residuals given by some of the latter, and it was decided to secure further observations here around the peak and on the descending branch of the curve to enable a more

accurate period and more consistent and homogeneous elements to be determined.

Further, the question of a second spectrum shown by two of the Yerkes, and also possibly on some Ottawa plates, should if possible be settled.

The first series of additional plates in October 1912 was, through an oversight, unfortunately taken at the wrong time and it was not until January 1914 that plates at the proper epoch were obtained.

When these measures were combined with the earlier ones it was at once seen that the previous period of 140·50 days obtained from comparison of the Ottawa and earlier observations was not exact but that it would have to be increased about 0·2 days. Observations 7 periods apart at approximately the same place on the very steep descending branch enabled the period to be determined quite accurately as 140·70 days.

With this period all the observations were combined into 18 normal places, each plate being arbitrarily weighted according to its general quality and the number of lines measured. The weighted velocities and phases of these normal places are given in the accompanying table, the initial epoch T_0 being taken as Julian Day 2,418,000.

The number and positions of these normal places were so chosen, and at the same time the extreme range of phase in any one of them was relatively so small, that they satisfactorily represent all the observations.

Their weights are submultiples of the sums of the weights of the plates therein, so taken for convenience of the least squares solutions that the maximum weight is unity. The residuals are those determined from the final elements.

NORMAL PLACES.

No.	Wt.	Phase	Velocity	Residual	No.	Wt.	Phase	Velocity	Residual
1	1	5·37	+44·84	+1·26	10	$\frac{1}{2}$	58·05	+37·97	−4·00
2	$\frac{1}{4}$	12·75	47·10	+1·12	11	$\frac{2}{5}$	64·35	28·76	+0·88
3	$\frac{1}{2}$	23·24	50·15	−0·07	12	$\frac{1}{4}$	70·12	26·90	+0·01
4	1	34·81	58·20	+0·93	13	$\frac{1}{6}$	80·69	33·50	+4·99
5	$\frac{1}{2}$	44·15	68·20	+0·57	14	$\frac{2}{5}$	87·20	35·04	+5·17
6	$\frac{1}{6}$	48·05	74·20	−0·54	15	$\frac{3}{8}$	94·83	33·87	+2·36
7	$\frac{1}{6}$	53·12	76·10	−3·33	16	$\frac{3}{4}$	111·28	29·98	−5·04
8	$\frac{1}{12}$	54·49	70·70	−1·07	17	$\frac{1}{2}$	125·55	33·63	−4·58
9	$\frac{1}{4}$	56·26	62·70	+7·26	18	$\frac{1}{2}$	133·39	40·08	−0·04

When the normal places were plotted on cross section paper preliminary elements suiting the velocity curve fairly well were, with

the experience gained in the previous determination, soon obtained by the aid of Dr. King's graphical method.[1]

The values adopted were:

Period	....	140·70 days
e	....	0·7
ω	....	55°
K	....	26·25 km
T	....	J.D. 2,418,054·80
γ	....	+42·21 km

From these preliminary elements a least squares solution using Schlesinger's convenient method[2] was carried through, resulting in the following values of the elements:

Period..................	P =	140·70 days.
Eccentricity.............	e =	0·717± ·022.
Longitude of apse........	ω =	54°·16± 4°·35.
Semi-amplitude	K =	27·12 ± 1·44 km.
Periastron passage.......	T =	J.D. 2,418,054·723±0·520
Velocity of system.......	γ =	+42·59 km.
Maximum velocity.......	=	81·10 km.
Minimum velocity.......	=	26·85 km.

Projected length semi-axis major a sin. i = 37,471,000 km.

These elements may be considered final for $\Sigma\ pvv$ is only reduced from 75·04 to 72·87 and the differences between the values obtained by substituting in the observation equations and those obtained from the ephemeris from these elements are very small.

The comparatively high values of the probable errors of the elements are due principally to the abnormal deviations, between phase 70 and 134, from the velocity curve drawn from these elements and shown in the full line in the accompanying figure. These deviations, which will be more fully discussed later, make the probable error of a normal place of unit weight and consequently the probable errors of the elements nearly double what they would otherwise be.

From a carefully drawn curve on a large scale, the residuals from the observations were obtained and are given in the last column but one of the table of observations. From these residuals the probable error of a single Ottawa plate comes out as ±3·6 km per second.

It will be of interest to compare the probable errors for the different dispersions used and these are given herewith.

[1]Astrophysical Journal XXVII p. 125.

[2]Pub. Allegheny Observatory I p. 33.

Spectograph	Å per mm at $H\gamma$	Number of Plates	Probable Error Single Plate
I	33·4	45	±3·7 km.
III R }	20·2 }	3 }	3·2
III S }	17·6 }	11 }	
III L	10·1	9	3·9

There is very little difference in the accuracy of measurement with the different dispersions the advantage seeming to lie with the three-prism dispersion and short cameras. The advantage of increased linear scale is offset evidently by increased diffuseness of the lines. Considering the character of the spectrum and the presence of some abnormal effect, the accuracy may be considered satisfactory.

In the velocity curve drawn from these elements the normal places are represented by circles. It will be seen that, considering the diffuse character of the spectrum lines, the agreement is quite satisfactory, excepting between phases 70 and 134, where there is a marked double hump. As the five normal places in this region have on the average four plates each, it is evident that this deviation must be considered to have a probable objective existence.

It is impossible to give a definite cause for this abnormal effect. As its period is approximately half the main period and as there seems to be a continuance of this effect farther along the velocity curve, one apparent explanation would be a secondary disturbance of half the period of the binary. Although such an effect does not admit of any probable physical explanation, it was thought worth while to determine the elements of the orbit on this supposition.

Assuming suitable preliminary elements and carrying through a least squares solution, adding terms for the amplitude and phase of a simple sine curve superposed on the velocity curve, the following elements were obtained.

Periods.....................140·70 days and 70·35 days.
Eccentricity ....$e = 0\cdot711$
Long. of apse ....$\omega = 50°\cdot80$
Semi-ampl. primary..........$K = 29\cdot03$ km
Periastron passage ....T = J.D. 2,418, 054·641.
Veolcity of system ....$\gamma = +42\cdot63$ km
Semi-ampl. sec ....$K = 3\cdot57$ km.
Phase ascending node sec.....J.D. 2,418,067·42.
Max. vel. primary...........84·71 combined 81·1
Min. " " ....26·65 " 27·0

The compound curve is shown in dotted lines in the figure and it is quite evident that it does not represent the observations much if any more satisfactorily than the simple curve, for, while the agreement is better between phases 80 and 130, it is poorer at other parts. The average plate residual is only reduced about 5% by the introduction of the secondary.

One possible explanation of the deviations is the presence of the spectrum of the companion to the principal star and the displacement of the measured velocities towards the γ line by the blend effect of the two spectra.

It is difficult to see how such a blend effect can cause deviations of the peculiar character shown here, as the curve goes through a complete cycle below the γ line and exhibits no evidence of blending above this line. Yet Harper's orbit of θ Aquilae[1], a binary whose elements are quite similar to those of θ^2 Tauri, shows similar deviations below the γ line though not so strongly marked as here.

In the case of θ Aquilae, it was later shown that this was due to the presence of a second spectrum with the resultant blend effect.

The inference is that the second spectrum is present in θ^2 Tauri; but as yet no reasonable evidence to that effect has been secured. On two of the early plates obtained at Yerkes, the second spectrum was measured and on four obtained here some apparent doubling was observed. The results at Yerkes and the attempted measures here, given in the last column of the table of measures, however all bring the secondary spectrum in impossible positions. For example, the secondary velocity in one plate and the primary velocity in the other plate at Yerkes fall within two or three kilometre of the γ line, while the velocities of primary and secondary in every suspected case here are in equally impossible relative positions. Furthermore, later trials on these suspected plates found me unable to repeat my measures and I strongly doubt the reality of the doubling.

As previously stated, plates have been especially secured here near the maximum positive velocity, when the doubling should be more pronounced, with three different dispersions; but in no case can doubled lines be definitely seen, and while there is possibly a second spectrum present the lines are so broad diffuse and lacking in contrast that I doubt whether it is possible to definitely settle the question.

Other reasons may be cited for suspecting abnormal conditions in this star. The large residuals from this orbit of some of the plates obtained at the Lick and Yerkes Observatories, the average residual being $8 \cdot 4$ as compared with $4 \cdot 1$ km at Ottawa, are much greater than can be explained by the poor character of the spectrum or by the

[1]Journal R.A.S.C. III p. 87, Mar.-April, 1909.

choice of different lines with different wave lengths for measurements.

Another reason is to be found in the difference between the velocity of the system obtained here + 42-6 km per second and that obtained from its stream motion + 39·2. θ^2 Tauri is of special interest as being one of the moving stream in Taurus described by Prof. Boss.[1] His computed radial velocity for θ^2 Tauri is 40·5 km per second, 2·1 km less than the Ottawa value. His velocity is based on Küstner's determination of the radial motion of three other stars of the group. In a later discussion of the Taurus stream by Wilson[2] in which the computed values are based on the radial velocities of 8 stars of the stream determined by Campbell, and hence of much greater weight, the velocity of θ^2 Tauri comes out at 39-2 or 3·4 km smaller than the Ottawa value.

It seems to me probable therefore that the Ottawa γ is over 3 kms too high, and, though it is possible to explain this systematic difference by incorrect identifications or wave lengths, it is more likely due to some cause which may be also operative in producing the curious humps in the curve and causing the early observations to have such unreasonably large residuals.

It is of interest to interpolate here that if Boss's value of the proper motion and of the distance of the convergent be accepted the value of the parallax of θ^2 Tauri is 0·023, equivalent to a light journey of about 140 years.

The similarity between the velocity curve of θ^2 Tauri and that of the Cepheid variable W. Sagitarii[3] is quite marked, the deviations from simple elliptic motion occurring in exactly the same relative positions in the orbits and being of approximately equal relative magnitudes.

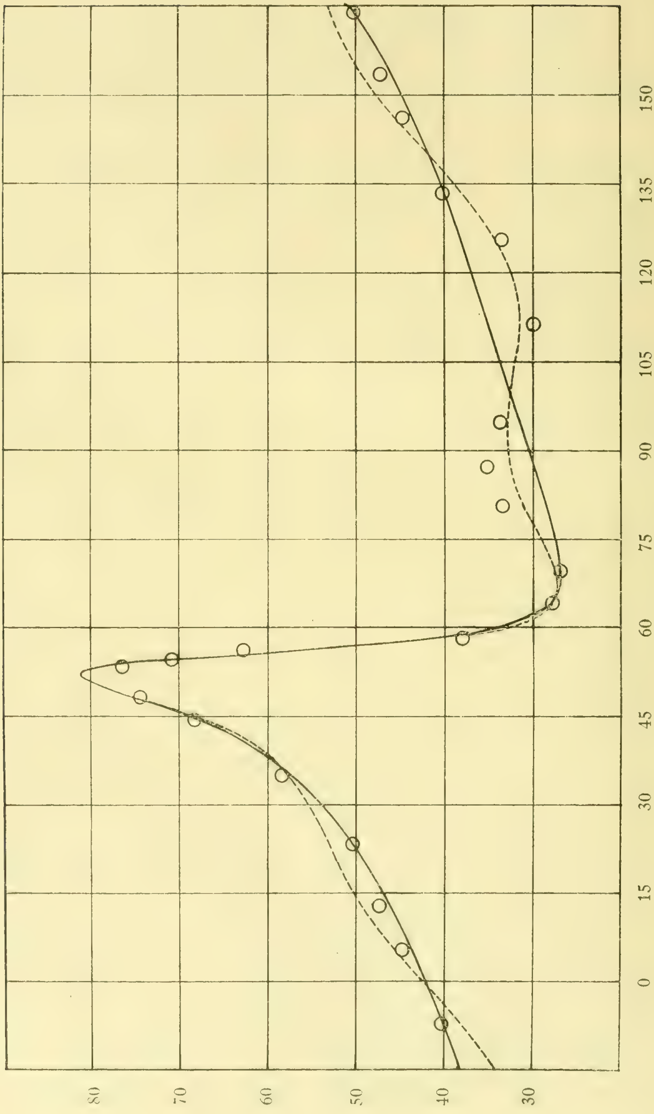
Moreover except in the longer period and higher eccentricity the elements are quite similar and it may be that the abnormal effects are produced by the same causes. Although the range must be small it is possible that accurate photometric observations might show θ^2 Tauri to be variable and it would be of interest to have this tested.

Although it is possible that a better orbit would be obtained if a considerable number of additional spectra were made and measured, the character of the spectrum lines is such as to render this additional work of doubtful value.

I have pleasure in acknowledging the interest and helpful suggestions of Dr. King in this work.

DOMINION OBSERVATORY,
Ottawa, Feb. 1915.

[1]Astronomical Journal XXVI p. 31.
[2]Popular Astronomy XX p. 359.
[3]Astrophysical Journal XX p. 172.



Velocity Curve of θ^2 Tauri

A Systematic Scheme for Experimental Work with Fertilizers.

By A. T. STUART, B.A.

PRESENTED BY DR. FRANK T. SHUTT, F.R.S.C.

I. THE IMPORTANCE OF THE STUDY OF FERTILIZERS.

There are perhaps few problems in agriculture which have aroused so much discussion and upon which are held such conflicting opinions as the fertilizer question. The reason for this is probably to be found in the great number of variables to be encountered—soil, temperature, light, heat, water supply, evaporation, drainage, aëration, fertilizers used, farm crops, rotations, etc. The consensus of opinion at the present time appears to be that few general recommendations can be made but that each and every case must be studied separately.

This is rather an unfortunate conclusion for the individual farmer. In the first place, he is, of necessity, ill equipped to study a question which has aroused so much discussion even among experts and, secondly, he cannot apportion more time to this than to other duties. The least which might be offered him is a workable plan for the prosecution of his enquiries.

In spite of all this every one now admits the benefits to be attributed to a judicious use of fertilizer. The mere fact that the farmers of the world now spend some hundreds of millions of dollars annually for fertilizer is sufficient indication of their value. A "fertilizer experiment" is but a means devised to measure or compare values. We, therefore, admit, in fact, are forcibly impressed, by the importance of these values and yet have no very satisfactory measure to translate the same into terms of dollars.

II. CONSIDERATIONS CONCERNING PLANS OF EXPERIMENTS.

It is evident that almost innumerable variables, as suggested above, are involved in the "equation." The solution of the problem under perfect and ideal conditions would demand the complete elimination of all variables other than the one under investigation, which in the case of fertilizer experiments is the quantity or variety of fertilizer material. Obviously this is impossible; but it is the purpose of this paper to consider the matter, first, from the purely theoretical point of view and, later, to find just how far it can be applied in practice.

If the object be not lost sight of in the process we may arrive at a point where useful recommendations can be made which are of general application and, for the rest, a simple working plan may be evolved.

III. THE LAW OF MINIMUM.

If we admit that fertilizers effect increases in growth we must realize a limit to these effects, otherwise we could continue to infinity. It is also reasonable to suppose that this limit is constant, under constant conditions, and can be attained by any "complete" fertilizer if rightly handled and applied in sufficient amounts to bring up to the requirements each of the elements contained therein. This, of course, may demand different methods of application—for instance $NaNO_3$ may require slightly different practice than $(NH_4)_2SO_4$—but each complete fertilizer, under its own ideal condition, should effect a common limit to increase in growth.

If now several "complete" fertilizers are added in excess of requirements we should expect the increase in crop production to be the same in each case. If the increases are not the same it is perhaps better to assume that the "working conditions" for the fertilizers were not ideal rather than to assume that one fertilizer is inferior to another; but having once adopted our method of application, then we can choose the fertilizer responding best to that method.

The work in fertilizer experiments recorded in the literature would indicate that too little regard has been had to the law of minimum as studied by Liebig and Mitscherlich. A fertilizer is said to be applied in minimum only when the smallest amount is used which is necessary to produce the largest increase in growth. All comparisons should be made in minimum.

According to Liebig the increase is directly proportional to the application of the element in minimum. Mitscherlich has modified this by stating that the "increase in plant growth with unit increase of the element in minimum is proportional to the decrement from the maximum" (see diagram I). Applications, then, applied in excess effect no further increase and hence the line becomes straight.

AN APPLICATION OF THE LAW OF MINIMUM.

It is evident that, if we wish to compare the effectiveness of fertilizers, singly or mixed, we must discover the minimum in each case before drawing conclusions. This point is to be found by making applications in several amounts and, judging by results, to obtain the minimum. For each material or mixture we can plot a curve according to Mitscherlich (see diagram II).

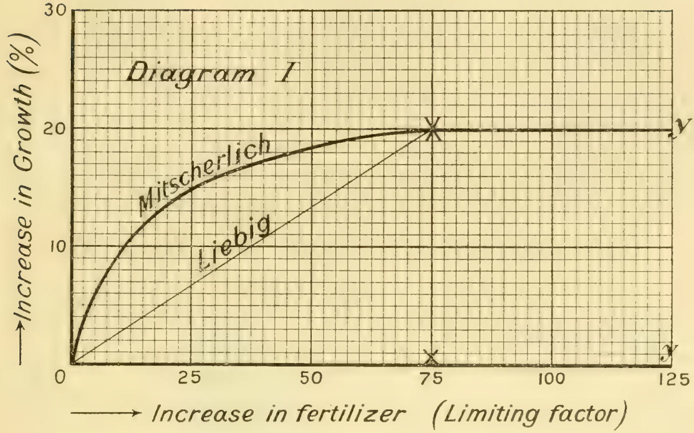


Diagram I
Increase in Growth (%)
30
20
10
0
25
50
75
100
125
Mitscherlich
Liebig
y
Increase in fertilizer (Limiting factor)

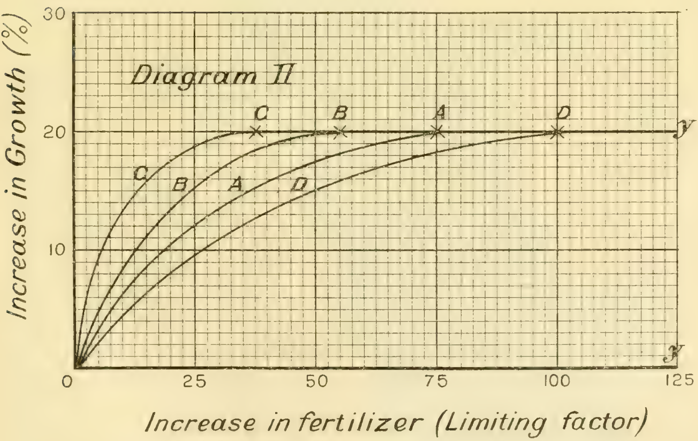


Diagram II
Increase in Growth (%)
30
20
10
0
25
50
75
100
125
C
B
A
D
y
Increase in fertilizer (Limiting factor)

In the illustration it is evident that C represents the most effective fertilizer, because the least amount of it is required. But suppose, as is ordinarily done, that each material had been applied in excess—Y pounds per acre. The growth in each case would be represented by the point Y on the curve, or roughly the same in each case. The conclusion would be that each fertilizer is equally effective, whereas C is twice as effective as A. If any great differences should appear these are more likely to be attributed to conditions and time of the applications being more favorable to one than to another; a slight change in environment might make the differences in the opposite direction.

IV. A COMPREHENSIVE PLAN FOR THE STUDY OF FERTILIZERS.

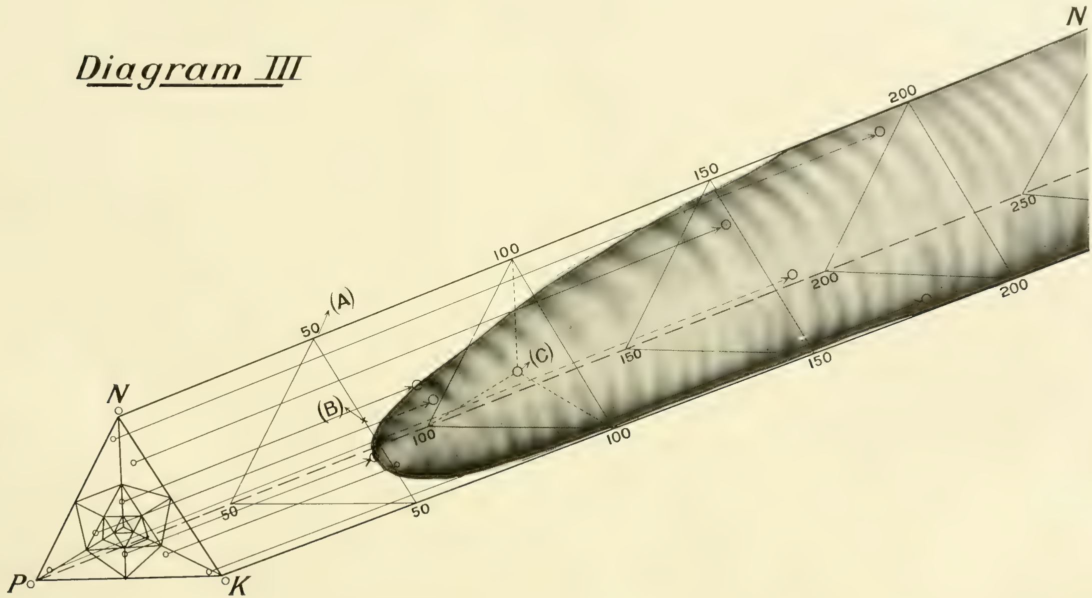
All possible combinations of three things can be represented on a plane three dimension diagram. It will be interesting to apply this to the study of fertilizers.

Since it might upset the symmetry of the diagram the use of the usual factors—N, P_2O_5 and K_2O—will be discarded and we will use only the ratio of the elements—N, P and K. Each corner will represent a single element, the sides combinations of two in all possible proportions and the area in the centre all possible combinations of three elements. Every fertilizer "formula" or single substance or mixture is therefore represented by a point on the diagram.

By starting with the figure we can study fertilizers systematically and not overlook anything in the way of "formulae". The area can be divided up strategically and every crevice and corner explored. If we now add a 4th dimension perpendicular to this plane the figure is resolved into a solid diagram, a prism, of 4 dimensions. This 4th dimension can be used to represent the total quantity of elements applied (the sum of N, plus P, plus K). On the diagram we can now represent all possible amounts and proportions. (see diagram III).

Every point on or in the prism—on an edge, on a face or internal—has a definite meaning. The point A, part way up the N edge, means a fertilizer containing only nitrogen and applied at the rate of 50 lbs. of nitrogen per acre (333 lbs. $NaNO_3$). The point B, in the centre of the NK side, part way up, represents a fertilizer containing equal amounts of nitrogen and potassium and applied at the rate of 50 lbs. per acre (25 lbs. nitrogen plus 25 lbs. potassium, such as 166 lbs. $NaNO_3$ plus 62.5 lbs. KCL). The point C, right in the centre of the prism, part way up, represents a fertilizer containing equal amounts of nitrogen, phosphorus and potassium and applied at the rate of 100 lbs. per acre (33.3 lbs. nitrogen plus 33.3 lbs. phosphorus plus 33.3 lbs. potassium, such as a mixture of 222 lbs. $NaNO_3$ plus 476 lbs. Acid phosphate plus 83 lbs. KCL).

Diagram III



If now, we could succeed, as outlined before, in eliminating all variables, other than the amount of the fertilizer required, we could locate exactly the minimum for each and every point in the triangular base of the prism. From each of these points we could erect a wire cut in correct length to represent the minimum for that point. The result would be a bundle of wires of different lengths standing up inside the prism and completely covering the triangular base. We can now join up the uneven ends of these wires by a surface.

Judging from the results of fertilizer experience, it is likely that the shortest wires would be at some point towards the centre, from where they would lengthen towards the sides and corners. The surface now formed by joining the ends of the wires would somewhat resemble an inverted cone inside the prism. The apex of this cone is the answer and from it is read off the fertilizer required and the correct amount.

V. THE PLAN APPLIED TO FERTILIZER EXPERIMENTS.

1. Control of the variables.

At the start it would be wise to restrict the work, in so far as is possible, to certain constants. For this the greenhouse, in the case of certain crops, might enable us to conduct some of the preliminary work. Although of course no absolute readings could be made from this work, the larger differences might be ascertained and the work, now narrowed down considerably, transferred to actual conditions of the field. In the greenhouse we can fairly effectively control all the variables and reduce these to constants—soil, water, temperature, air, etc., etc., Also it would permit of greatly enlarging the number of tests to be made of the various points in the triangular diagram.

Having now eliminated from discussion many of the mixtures of fertilizers, we could turn to the field work. We could still control the variables somewhat by following uniform practices and by resorting to as many averages as possible. As an example we might choose one of the commonest rotations, such as roots (first year), grain, seeded with timothy and clover (second year) and hay (third year). Observations could be made throughout the complete rotation and due regard had to the "after effects" of fertilizer, the sum of all to be taken as the reading. In passing, it seems possible that, by such means, the best treatment for each crop in the rotation could be worked out, rather than the usual practice of fertilizing in excess but one crop in the rotation and relying on the residues to benefit other crops. In this way costs could be properly proportioned and charged up equitably against each crop.

2. Choice of materials for fertilizer.

Perhaps the first consideration would be the choice of the most favorable materials for fertilizer. For this, the element to be tested is tried in various proportions, the other elements always being present in excess of requirements. We thus find the respective merits of nitrogen in its various forms or mixtures of forms, similarly the best forms of phosphorus and potassium. To approximate these values we need not apply each in more than 3 or 4 amounts (see table I).

3. The use of the diagram in practice.

Without having recourse to the greenhouse and also restricting the number of plots in the field, we can divide up the plane 3 dimension diagram by choosing not more than 18 points and form it into various triangles by joining up these points (see diagram IV). The mixtures of elements designated by these 18 points need not be tried in more than 3 or 4 amounts. In this way we find the maximum possibilities for each point by having regard to the law of minimum. If this work is sufficiently exhaustive the correct "formula" is located with a fair degree of exactness. This may be at one of the points or within a certain triangle. By using perpendiculars, as mentioned before, a conical surface might be formed, the apex of which is found by interpolation. On the other hand we could simply enter on the diagram the maximum profit (in $) possible for each point and perhaps also make use of this as a 4th dimension.

A few other plots might be added to round out the experiment. Point 17 is chosen, representing the "formula" 4–8–10 (N–P_2O_5–K_2O) and it is tried in combination with manure and with subsequent treatments in the second and third years. (see table II).

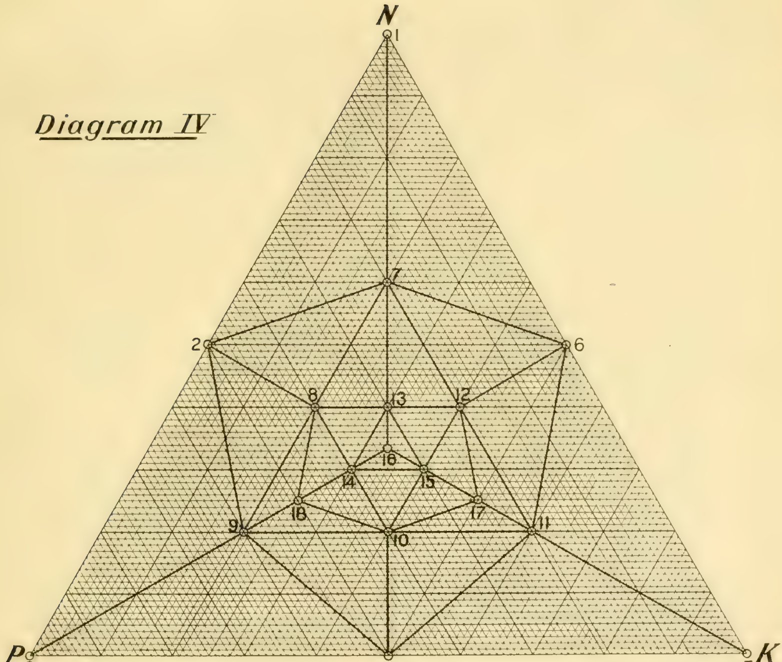
POINTS ILLUSTRATED BY THE DIAGRAM.

The plan of procedure is of very general application and by it each of the many farm practices can be studied—from field crops to orchards and garden truck.

It is interesting to study the diagram (IV) and locate on it many of the commercial brands of fertilizer. It will be found that by far the greater number of the brands on the market, and of those in general use, are located inside the triangle formed by joining the points 8, 9 and 10. The chief logic in this that is apparent off-hand is the fact that they are farthest removed from the N and K corners—the most expensive—and are closer to the P corner—the cheapest. Of late years, however, the use of others higher in potassium (as 4–8–10 or point 17) is becoming more general.

Most commercial fertilizers are richer in phosphorus than in nitrogen or potassium and yet the products of agriculture and manure,

Diagram IV



which, in their content of N, P and K, must of necessity closely represent them, correspond roughly to the formula 2–1–2 (point 12, on the opposite side of the diagram from the commercial fertilizers).

Again, it is common practice to apply N, P and K alone, represented by the extreme corners, and mixtures of any two, represented by various points on any of the sides of the diagram. It is hardly right, therefore, to explore the diagram in certain sections to the disregard of others.

It is realized that, with experience, many modifications could be made; but it is felt that some such systematic method of study is required. On such crops, too, as potatoes, it is felt that the usual profits obtained so far out-distance the differences in costs of fertilizers that it will be hard to differentiate which complete fertilizer should be used. This point can be located, in fact would of necessity have to be, with greater nicety in crops where money values are much less per acre than is the case with potatoes.

Table I.—To Compare Different Forms of N, P, and K.
(Rotation of three years' duration).
Lbs. Elements Per Acre.

Plot	Nitrogen applied as		Phosphorus applied as			Potassium applied as
	$NaNO_3$	$(NH_4)_2SO_4$	Acid Phos.	Basic Slag	Bone Meal	KCl
IA.	20		14	14		60
B.	15		14	14		60
C.	10		14	14		60
IIA.		20	14	14		60
B.		15	14	14		60
C.		10	14	14		60
IIIA.	15	15	28			60
B.	15	15	21			60
C.	15	15	14			60
IVA.	15	15		28		60
B.	15	15		21		60
C.	15	15		14		60
VA.	15	15			28	60
B.	15	15			21	60
C.	15	15			14	60
VIA.	10	10	14	14		60
B.	7.5	7.5	14	14		60
C.	5	5	14	14		60
VIIA.	15	15	9	9		60
B.	15	15	7	7		60
C.	15	15	4.5	4.5		60

TABLE II.—TO OBTAIN THE "MINIMUM" FOR VARIOUS MIXTURES
(Rotation of three years' duration)

Illustration—½ N to be applied as $NaNO_3$ (15% N).
½ N to be applied as $(NH_4)_2SO_4$ (20%N).
½ N to be applied as Acid Phosphate (16% P_2O_5 or 7%K).
½ P to be applied as Basic Slag (16% P^2O^5 or 7%K).
All K to be applied as KC1 (48% K_2O or 40% K).

LBS. ELEMENTS PER ACRE

Plot	½ Nitrogen applied as		½ Phosphorus applied as		All Potassium applied as
	$NaNO_3$	$(NH_4)_2SO_4$	Acid Phos.	Basic Slag	KCl
IA.	15	15			
B.	11.25	11.25			
C.	7.5	7.5			
IIA.	20	20	20	20	
B.	15	15	15	15	
C.	10	10	10	10	
IIIA.			25	25	
B.			18	18	
C.			10	10	
IVA.			25	25	50
B.			18	18	36
C.			10	10	20
VA.					60
B.					45
C.					30
VIA.	25	25			50
B.	18	18			36
C.	10	10			20
VIIA.	60	60	20	20	40
B.	45	45	15	15	30
C.	30	30	10	10	20
VIIIA.	40	40	40	40	40
B.	30	30	30	30	30
C.	20	20	20	20	20
IXA	20	20	60	60	40
B.	15	15	45	45	30
C.	10	10	30	30	20
XA.	12	12	24	24	48
B.	8.5	8.5	17	17	34
C.	5	5	10	10	20
XIA.	15	15	15	15	90
B.	11.25	11.25	11.25	11.25	67.5
C	7.5	7.5	7.5	7.5	45
XIIA.	30	30	15	15	60
B.	20	20	10	10	40
C.	10	10	5	5	20

TABLE II—*Continued.*

LBS. ELEMENTS PER ACRE

Plot	½ Nitrogen applied as		½ Phosphorus applied as		All Potassium applied as
	$NaNO_3$	$(NH_4)_2SO_4$	Acid Phos.	Basic Slag	KCl
XIIIA.	26.66	26.66	20	20	40
B.	20	20	15	15	30
C.	13.33	13.33	10	10	20
XIVA.	20	20	27	27	40
B.	15	15	20	20	30
C.	10	10	13	13	20
XVA.	15	15	15	15	40
B.	11.25	11.25	11.25	11.25	30
C.	7.5	7.5	7.5	7.5	20
XVIA.	20	20	20	20	40
B.	15	15	15	15	30
C.	10	10	10	10	20
XVIIA.	15	15	15	15	60
B.	11.25	11.25	11.25	11.25	45
C.	7.5	7.5	7.5	7.5	30
XVIIIA.	20	20	40	40	40
B.	15	15	30	30	30
C.	10	10	20	20	20

Plot "A" mixture XVIIB.+15 tons manure+nothing in 2nd and 3rd years.
Plot "B" mixture XVIIB.+15 tons manure + 175 lbs. XVIIB 2nd and 3rd years.

Plot "C" mixture XVIIB. + 7½ tons manure + nothing in 2nd and 3rd years.
Plot "D" mixture XVIIB. + 7½ tons manure + 175 lbs. XVIIB 2nd and 3rd years.

Plot "E" 15 tons manure alone.
Plot "F" 7½ tons manure alone.

Plot "G" etc., check plots.

February, 1915.
Chemical Laboratory,
Experimental Farm,
Ottawa, Canada.

Notes on the Thermionic Current in a Carbon Filament Lamp.

BY A. S. EVE, D.Sc., F.R.S.C., McGill University.

It has been shown* that a lighted carbon filament lamp, having two loops, is affected by the movement of an electrically charged conductor in a manner which proves that the current is mainly unidirectional and is conveyed by electrons from the glowing filaments.

In order to study this phenomenon further, Dr. Johnson was kind enough to open a lamp, and affix a glass tube so that the globe could be silvered inside by Mr. Pye; a platinum wire was passed through the side of the globe and sealed hermetically, after which the lamp was exhausted and sealed by Dr. Johnson. The lamp worked perfectly well, except that it tended to heat rapidly when lighted, owing to the silver deposit absorbing the heat.

The platinum wire made good connection with the silver deposit on the inside of the globe, but the silver did not make contact with the leads to the carbon filament.

Various experiments could be made with this lamp, many of them analogous to those made by Fleming when he investigated the thermionic current, or Edison effect.

For example, if the silver deposit within, and the platinum wire through the glass globe, were connected to a delicate galvanometer, and thence to earth, a slight current was shown when the carbon glowed red. When the voltage was 110, and the carbon was at a white heat, the current increased several hundred-fold.

If connection was made between the platinum wire and the charged gold leaf system of an electroscope, the insulation remained good; but when the lamp was lit, even at a low voltage, the gold leaf collapsed immediately.

By adding capacity, using a Leyden Jar or two, to the insulated system, it was easy to show that the current from the dull red carbon to the silver coating was unidirectional, for the gold leaf system closed at widely different rates, according to the sign of the charge initially given to it.

A telephone was then connected, on the one side to the platinum wire, and on the other side to the hot water pipes. No sound was heard when the lamp was unlit, or when it glowed red at a low voltage. When 110 volts was applied to the lamp, a low hissing noise was heard in the telephone, and this gradually died away, after which the ma-

*Trans. R.S. Canada, p. 115, III, 1914.

chinery of the power house was clearly heard. This was probably caused by the slightly changing voltages due to the peaks of the waves in the direct current supplied.

It is rather fascinating to listen in this way to what is taking place inside the lamp, the thermionic current varying in sympathy with the power house. Sometimes the rushing or hissing noise would reappear, perhaps due to "strays" entering the Physics Building along the hot water pipes. These strays probably come, as Dr. Barnes suggested to me, from the street railway system, some half mile away, and are mainly dominant when a street car starts from rest.

An arrangement of the kind described might conceivably be used for detecting "strays".

15 Feb. 1915.

With a direct current from a dynamo there is sufficient variation in the voltage to obtain a sound just audible at 100, loud at 110, very loud at 130, and it might be described as an uproar at 140 volts. It might be expected that the intensity would increase until the lamp burnt out. Nothing of the sort. At 142 volts, the uproar is replaced by dead silence which continues up to 165 volts, as high as the lamp would stand.

The explanation may be gathered from Langmuir's paper, (Physical Review, Dec., 1913). The thermionic current does not increase with the temperature according to Richardson's Law, unless the vacuum is of a high order. With a moderate vacuum, the volume charge between the filament and silver causes the thermionic current to remain at a value nearly constant as the temperature is raised above a certain value. The thermionic current begins by obeying Richardson's law ($i = cdre^{-6}$) and then later approximates to a steady value.

Thus at low voltages, variations of voltage cause variations of temperature and consequent fluctuations of thermionic current, heard in the telephone.

Above 142 volts, however, for the particular lamp in question, a change of voltage and of temperature produces no change of current, and hence no sound can be heard in the telephone. The change from noise to silence is remarkably abrupt.

It is possible that this method may prove very convenient for testing the electric emission from various sustances, in different gases, and it suggests a method of measuring a high vacuum.

(*Röntgen Rays and Crystal Reflection.*)

The German Scientific Journals are not at present reaching Canada. It may therefore be of interest to place on record that in a recent number of the "Physikalische Zeitzchrift" there is a note by Seeman of Wurtsburg together with a beautiful photograph of the X ray spectrum of platinum. "It is absolutely filled with fine lines from 2° to 12° including the strong lines found by Bragg and Moseley. He has used a remarkably perfect crystal of rock salt and a very penetrating X ray bulb" (Rutherford). This note has come to me by way of Copenhagen and Manchester. It is clear that it will be possible to determine the exact values of the extremely short wave lengths of the various X rays stimulated by cathode rays in the electronic systems within platinum atoms. It is remarkable that the lines should be fine, indicating precise oscillation periods. The measurements when made will probably throw further light on the interesting *quantum* theory.

A. S. EVE.

The Penetrating Power of the γ Rays excited in lead by the β Rays of Radium E.

By J. A. GRAY, D.Sc.

(Presented by Dr. A. S. Eve, F.R.S.C.).

Barkla[1] and others have shown that under suitable circumstances, most elements can emit at least two types of X radiation, characteristic of the elements. They are called the X rays of the K series and of the L series, the former being much more penetrating, e.g. for silver, the mass absorption coefficient in aluminium (μ/ρ Al) = $2 \cdot 5$ for the rays of the K series and 700 for the rays of the L series Moseley[2] has examined the X ray spectra of many elements, and has shown for elements ranging from aluminium to silver, that in the rays of the K series there are at least two lines of different wave lengths, which he calls the α and the β lines. Of these lines, the α line is the more intense, and has the longer wave length. Its frequency ν_α is connected with the atomic number N by an approximate relation of the form—

$\nu_\alpha = C(N-1)^2$ where C is constant.

Rutherford and Richardson[3] had examined the rays of most of the γ ray products and showed that it was probable that these γ rays were characteristic of the elements emitting them.

Radium B emits three types of γ rays for which μ/ρ Al$=87$, $14 \cdot 7$, $0 \cdot 188$, RaC one type for which μ/ρ Al$=0 \cdot 0424$, and Rutherford and Andrade[4] have since examined the spectra of the γ rays of these elements. In their first paper they showed by direct experiment, that the rays for which μ/ρ Al$=14 \cdot 7$ were identical with the lead X rays of series L. As both RaB and lead have the same atomic number $N=82$, this shows that these rays form the L series for radium B.

In the second paper they give the wave lengths of the more penetrating γ rays of Ra B, and of the γ rays of Ra C.

The wave length of the most intense line of the γ rays of radium B (μ/ρ Al$=0 \cdot 188$) is $1 \cdot 65 \times 10^{-9}$ cms. and the frequency $\nu = 1 \cdot 83 \times 10^{19}$

[1]Barkla and Sadler, Phil Mag. 16, p. 550, 1908.
Barkla and Nicol, Proc. Phys. Soc. 24, p. 9, 1911.

[2]Moseley, Phil Mag. vol. 27, p. 703, 1914.

[3]Rutherford and Richardson, Phil Mag. 25, p. 722 (1913), 26, p. 324, 1913.

[4]Rutherford and Andrade, Phil Mag. 27, p. 854, 1914, 28, p. 263, 1914.

Using Moseley's relation—

for $N=82$, $\nu_a=1 \cdot 72 \times 10^{19}$

$N=83$, $\nu_a=1 \cdot 75 \times 10^{19}$

The agreement between the calculated and the experimental frequency in the case of radium B suggests that the more penetrating rays of radium belong to the K series. In the case of radium C however, the observed frequencies are so much greater (the radiation consisting of three lines with frequencies $=2 \cdot 61 \times 10^{19}$, $3 \cdot 03 \times 10^{19}$, and $4 \cdot 22 \times 10^{19}$) that it is evident that the γ rays of Ra C cannot belong to the K series of that element.

Rutherford and Andrade consider that these rays belong to yet another series, which for convenience they have called the H series.

We know that a β ray must have energy E, approximately $=h\nu$ to excite X rays of frequency ν, h being Planck's constant $6 \cdot 55 \times 10^{-27}$ erg. sec., and further that Xrays of frequency ν can excite β rays of energy E approximately $=h\nu$.

Applying the relation $E=h\nu$ to the line of radium C spectrum with the greatest frequency, we find that a β ray must have a speed corresponding to a potential drop of 177,000 volts before it can excite this radiation. As Rutherford and Andrade state, this is not beyond the possibility of experiment with a suitable X ray tube, so that it ought to be possible to observe the H series of characteristic radiations by applying a sufficiently high voltage say 200,000 to an X ray tube in which a heavy element like platinum forms the anticathode. Radium E, however, if intense enough gives one a more convenient source of high speed β rays than the X ray tube, the β rays varying in speed from $2 \cdot 72$ to $1 \cdot 50 \times 10^{10}$ cms. per sec., the average speed being $2 \cdot 40 \times 10^{10}$ cms. per second, these rays corresponding to a potential drop of about 300,000 volts. The fastest rays correspond to a drop of 600,000 volts.

Some time ago the writer[1] examined the properties of γ rays excited in different materials by these β rays, particularly of the γ rays excited in lead, and below an account is given of the absorption of the γ rays excited in lead, which shows that rays of the H series are not excited in the lead. The source of β rays, a very active specimen of radium (D+E+F) was placed between two sheets of India paper, and then between two lead sheets $0 \cdot 1$ mm. thick in which the γ rays were excited. To absorb any β rays issuing from the lead, a plate of graphite 5 mm. thick was placed above the upper lead plate. The preparation was placed about 3 cms. below an electroscope, the bottom of which consisted of aluminium $1 \cdot 25$ mm. thick. The

[1]Gray, Proc. Roy. Soc. 1911, A vol. 85, p. 121; 1912, A vol. 86, p. 513; 1912, A vol. 87 p. 489.

absorption of the γ rays in lead was then observed in the usual way. The initial reading was 15 divisions per minute. The results are given in the table below.

Thickness of lead absorbing screen	Intensity of rays	μ/ρPb	μ/ρAl
0·	15·		
0·132 mms.	8·74	3·67	0·135
0·264	6·34	2·13	
0·396	4·78	1·88	0·115
0·528	3·62	1·80	
0·76	2·48	1·32	
1·52	1·21	0·82	0·100
4·07	0·35	0·44	
7·78	0·17	0·16	

The third column gives the average mass absorption co-efficient of the rays issuing from the different absorbing screens. For example the first lead screen cuts the radiation down to 58·2%, giving μ/ρPb $=3\cdot67$ for the 1st screen.

Testing the rays by aluminum 12 mms. thick, we find that for the same rays $\mu/\rho\text{Al}=0\cdot135$. The radiation coming through 0·76 mm. of lead is reduced from 2·48 to 1·21 divisions per minute by a screen 0·76 mm. thick, giving $\mu/\rho\text{Pb}=0\cdot82$. The same rays tested by the aluminium screen gave $\mu/\rho\text{Al}=0\cdot100$.

For the rays of the radium C, $\mu/\rho\text{Al}=0\cdot0424$, and $\mu/\rho\text{Pb}=0\cdot044$, after the rays have passed through a centimetre of lead.

The atomic number for lead $=82$ and consequently the H series for lead should have about the same penetrating power as the γ rays of Ra C. The table shows that the γ rays excited in the lead are decidedly less penetrating than would be the rays of the H series.

Even the most penetrating rays only correspond in penetrating power to the γ rays of actinium, although the readings are so small that it is difficult to measure them accurately. On the other hand, there is a possibility that part of the more penetrating radiation is due to a very slight amount of radium, from which the radium D had been separated. However, for the rays of actinium $\mu/\rho\text{Al}=0\cdot080$ app. and this agrees, approximately, with the values obtained in the last column.

It is therefore concluded that although the β rays of radium E have more than sufficient speed, they do not excite the characteistic radiation of series H in lead, and the experiment makes it doubtful whether the H series can be excited in this way.

We may account for the absence of rays of this series as follows: Radium B, Radium C, and radium D emit different types of γ rays, although radium B and radium D have the same atomic number 82, and radium C the atomic number 83. To explain these differences, Rutherford assumes that a β ray ejected from the nucleus of a radioactive atom always moves in a particular direction with respect to the atom, and therefore may excite one type of characteristic radiation on one product, whereas in another product, it may excite quite a different type. If this is the case, it may be that the probability of a ray of radium E entering a lead atom in the proper direction to excite the γ rays of the series H is too small for this type of γ rays to be detected. Further, there is a possibility that the γ rays for radium C are excited in the nucleus and not in the electronic rings surrounding the nucleus, in which case the probability of the γ rays being formed by β rays entering the atom would be very small. In any case it will be noticed that the β rays of radium E, with rays corresponding to potentials of 150,000 to 600,000 volts, excite γ rays corresponding to β rays with a potential drop of less than 177,000 volts. The chance of a fast ray being stopped in an atom, sharply enough to give up all its energy in the form of γ radiation seems very small. The fastest rays with which one is ever likely to experiment are those of radium C and thorium C, some of which correspond to a potential drop of over 2,000,000 volts, and it may be noted that the γ rays excited in lead by the β rays of radium C[1] are less penetrating on the whole, than the rays of radium C, although there may be more penetrating rays present. It seems quite possible that the most penetrating γ rays that are excited by β rays may not depend so much on the speed of the rays as on the structure of the atom in which the γ ray is excited. In other words there may be a limit to the penetrating power of γ rays formed by β rays in any particular element.

Summary.

1. An account is given of the work of Rutherford and Andrade which has led them to the conclusion that two of the types of γ rays emitted by Ra B belong to the K and L series of characteristic radiations, while the γ rays of radium C belong to yet another series, which they have called the H series.

2. An account is given of an experiment by the writer on the γ rays excited in lead by the β rays of radium E, which shows that rays of the H series are not excited to any extent by these fast rays, although they have sufficient energy.

[1]Chadwick, Phil Mag. 24, p. 594, 1912.

Two Identities associated with generalized Legendrian coefficients.

BY JAMES HARKNESS, M.A., F.R.S.C.

The functions $K_{v,s}(\alpha)$, or $K_{v,s}(\cos\theta)$, are generalized Legendrian coefficients, defined by

$$(1-2\alpha x+x^2)^{-v}=1+\sum_{s=1}^{\infty}K_{v,s}(\alpha)x^s\ ,\ v\neq o,$$

where $\alpha=\cos\theta$. The expressions for the earlier functions $K_{v,o}$, $K_{v,1}$, $K_{v,2}$, etc., are obtained at once by expanding $(1-2\alpha x+x^2)^{-v}$ as a power-series in x and equating coefficients on the two sides of the equation; *e.g.*, putting $K_{v,o}=1$, they are

$$K_{v,o}=1,$$
$$K_{v,1}=2v\cos\theta,$$
$$K_{v,2}=2v(v+1)\cos^2\theta-v,$$
$$K_{v,3}=\tfrac{4}{3}v(v+1)\ (v+2)\ \cos^3\theta-2v(r+1)\ \cos\theta,$$
etc.,

when v is put equal to $\frac{1}{2}$, these reduce at once, as they should do, to the standard expressions for the zonal harmonics $P_o\ (=1)$, $P_1(\cos\theta)$, $P_2(\cos\theta)$, $P_3(\cos\theta)$, etc., in terms of $\cos\theta$.

Since $\cos^n\theta$, where $n=0,\ 1,\ 2,\ 3,\ \ldots$, is expressible linearly in terms of the K's, it is evident that $\sin^{2n}\theta$ and $\sin 2n\dfrac{\theta}{2}$ can be represented as linear expressions in the K's. We propose to show that the associated formulae form a link of connection between two important results in the theory of series using Bessel Functions:

(1)

$$\frac{J_{v-\frac{1}{2}}(x\sin\theta)}{(\sin\theta)^{v-\frac{1}{2}}}=\sqrt{\frac{2}{\pi x}}\sum_{s=o}^{\infty}\frac{(v+2s)\,\Gamma(s+\frac{1}{2})\,\Gamma(v)}{\Gamma(v+s+\frac{1}{2})}K_{v,2s}(\cos\theta)\,J_{v+2s}(x);$$

(2)

$$\frac{J_v\left(2x\sin\dfrac{\theta}{2}\right)}{\left(2\sin\dfrac{\theta}{2}\right)^v}=\frac{2^v\,\Gamma(v)}{x^v}\sum_{s=o}^{\infty}(v+s)\ J^2{}_{v+s}(x)\,K_{v,s}(\cos\theta).$$

The former result is due to Nielsen (see his Handbuch der Theorie der Cylinderfunktionen, p. 278), the latter to Gegenbauer. Though the two types of infinite series are entirely distinct, there is as Nielsen has pointed out (l.c. p. 281) a resemblance in their appearance which is "in the highest degree remarkable".

We shall find it convenient to employ the function $R_v(x)$ defined by

$$2^v\ \Gamma(v+1)\ J_v\ (x)=x^v\ R_v\ (x),$$

so that

$$R_v\ (x)=1-\frac{\left(\dfrac{x}{2}\right)^2}{1.v+1}+\frac{\left(\dfrac{x}{2}\right)^4}{1.2.\overline{v+1}.\overline{v+2}}-\ \ldots\ldots\ldots$$

In terms of the R-function, Gegenbauer's formula becomes

$$\frac{R_v\left(2x\sin\frac{\theta}{2}\right)}{\Gamma(v+1)} = \Gamma(v)\sum_{s=o}^{\infty}(v+s)\,K_{v,s}(\cos\theta)\,\frac{\left(\frac{x}{2}\right)^{2s}}{\Gamma^2(v+s+1)}\,R^2_{v+s}(x).$$

The expression on the left-hand side is, after multiplication by $\Gamma(v+1)$, the power-series

$$1-\frac{\sin^2\frac{\theta}{2}}{1.v+1}x^2+\frac{\sin^4\frac{\theta}{2}}{1.2.\,v+1.v+2}x^4-\frac{\sin^6\frac{\theta}{2}}{1.2.3.\,v+1.v+2.v+3}x^6+\ldots; \quad \text{(I)}$$

that on the right-hand side can be converted into a power-series by using Schönholzer's expansion for $J^2_v(x)$ in the form

$$R^2_v(x)=\sum_{t=o}^{\infty}\frac{(-1)^t}{\Gamma^2(v+t+1)}\binom{2v+2t}{t}\left(\frac{x}{2}\right)^{2t}\Gamma^2(v+1),$$

where $\binom{n}{r}$ stands for the binomial coefficient ${}_nC_r$. In the first place we get the double series

$$\Gamma(v)\Gamma(v+1)\Bigg[v\,K_{v,o}\sum_{s=o}^{\infty}\frac{(-1)^s}{\Gamma^2(v+s+1)}\binom{2v+2s}{s}\left(\frac{x}{2}\right)^{2s}$$
$$+(v+1)K_{n,1}\sum_{s=o}^{\infty}\frac{(-1)^s}{\Gamma^2(v+s+2)}\binom{2v+2s+2}{s}\left(\frac{x}{2}\right)^{2s+2}$$
$$+(v+2)K_{v,2}\sum_{s=o}^{\infty}\frac{(-1)^s}{\Gamma^2(v+s+3)}\binom{2v+2s+4}{s}\left(\frac{x}{2}\right)^{2s+4}$$
$$+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\Bigg]$$

which, in turn, gives us the power series

$$\Gamma(v)\Gamma(v+1)\Bigg[v\,K_{v,o}\,\frac{1}{\Gamma^2(v+1)}$$
$$+\left(\frac{x}{2}\right)^2\left\{(v+1)\,K_{v,1}-v\binom{2v+2}{1}K_{v,o}\right\}\frac{1}{\Gamma^2(v+2)}$$
$$+\left(\frac{x}{2}\right)^4\Bigg\{(v+2)K_{v,2}-(v+1)\binom{2v+4}{1}K_{v,1}+$$
$$v\binom{2v+4}{2}K_{v,o}\Bigg\}\frac{1}{\Gamma^2(v+3)} \quad \text{(II)}$$
$$+\ldots\ldots\ldots\ldots\ldots\Bigg]$$

The general term within the brackets [ ] is

$$\left(\frac{x}{2}\right)^{2s}\left\{(v+s)\,K_{v,s}-(v+s-1)\binom{2v+2s}{1}K_{v,s-1}+(v+s-2)\binom{2v+2s}{2}K_{v,s-2}-\ldots\right\}\frac{1}{\Gamma^2(v+s)}$$

The comparison of the coefficients in (I), (II) shows that

$$1=K_{v,o}\,,$$

$$2^2\sin^2\frac{\theta}{2}=2\,K_{v,o}-\frac{1}{v}\,K_{v,1}\,,$$

$$\frac{1}{2!}\,2^4\sin^4\frac{\theta}{2}=\frac{2v+3}{v+1}\,K_{v,o}-\frac{2}{v}\,K_{v,1}+\frac{1}{v\,(v+1)}\,K_{v,2}\,,$$

etc.

The general form for these identities is

$$\frac{1}{s!}\,2^{2s}\sin^{2s}\frac{\theta}{2}=\frac{1}{v(v+1)\,(v+2)\ldots(v+s)}\left[v\binom{2v+2s}{s}K_{v,o}-(v+1)\binom{2v+2s}{s-1}K_{v,1}+(v+2)\binom{2v+2s}{s-2}K_{v,2}-\ldots\right].$$

when $v=\frac{1}{2}$, the identity becomes

$$\frac{1}{s!}\,2^{s+1}\sin^{2s}\frac{\theta}{2}=\frac{1}{1.3.5\ldots2s+1}\left[\binom{s}{2s+1}P_o-3\binom{2s+1}{s-1}P_1+5\binom{2s+1}{s-2}P_2-\ldots\ldots\ldots\right].$$

We shall now proceed to show that Nielsen's identity is based on the formulae that express the powers of $\sin^2\theta$ linearly in terms of the generalized Legendrian coefficients.

Expand both sides of

$$\frac{R_{v-\frac{1}{2}}\,(x\sin\theta)}{\Gamma(v+\frac{1}{2})}=\frac{1}{\sqrt{\pi}}\sum_{s=o}^{\infty}\frac{(v+2s)\,\Gamma(s+\frac{1}{2})\Gamma(v)}{\Gamma(v+s+\frac{1}{2})}K_{v,s}\,(\cos\theta)\,\frac{\left(\frac{x}{2}\right)^{2s}}{\Gamma(v+2s+1)}R_{v+2s}\,(x)$$

as power-series in $\left(\frac{x}{2}\right)$ and equate coefficients. After simple reductions the corresponding identities are

$$1=K_{v,o}$$

$$\sin^2\theta=\Gamma(v)\left[\frac{v+\frac{1}{2}}{\Gamma(v+2)}\,v\,K_{v,o}-\frac{\frac{1}{2}}{\Gamma(v+3)}\,(v+2)\,K_{v,2}\right],$$

$$\frac{\sin^4\theta}{2!} = \Gamma(v)\left[\frac{v+\frac{1}{2}.v+\frac{3}{2}}{2!\,\Gamma(v+3)}\,v\,K_{v,o} - \frac{v+\frac{3}{2}\cdot\frac{1}{2}}{1!\,\Gamma(v+4)}\,(v+2)\,K_{v,2} + \frac{\frac{1}{2}\cdot\frac{3}{2}}{\Gamma(v+s)}\,(v+4)\,K_{v,4}\right],$$

$$\frac{\sin^6\theta}{3!} = \Gamma(v)\left[\frac{v+\frac{1}{2}.v+\frac{3}{2}.v+\frac{6}{2}}{3!\,\Gamma(v+4)}\,v\,K_{v,o} - \frac{v+\frac{3}{2}.v+\frac{5}{2}.\frac{1}{2}}{2!\,\Gamma(v+5)}\,(v+2)K_{v,2} + \frac{v+\frac{5}{2}\cdot\frac{1}{2}\cdot\frac{3}{2}}{1!\,\Gamma(v+6)}\,(v+4)\,K_{v,4} - \frac{\frac{1}{2}\cdot\frac{3}{2}\cdot\frac{5}{2}}{\Gamma(v+7)}\,(v+6)\,K_{v,6}\right],$$

etc.

The general form for these identities is

$$\frac{\sin^{2s}\theta}{s!} = \Gamma(v)\left[\frac{v+\frac{1}{2}.v+\frac{3}{2}\ldots v+\frac{2s-1}{2}}{s!\,\Gamma(v+s+1)}\,v\,K_{v,o} - \frac{v+\frac{3}{2}.v+\frac{5}{2}\ldots v+\frac{2s-1}{2}\cdot\frac{1}{2}}{s-1!\,\Gamma(v+s+2)}\,(v+2)\,K_{v,2}\,, + \frac{v+\frac{5}{2}.v+\frac{7}{2}\ldots v+\frac{2s-1}{2}\cdot\frac{1}{2}\cdot\frac{3}{2}}{s-2!\,\Gamma(v+s+3)}\,(v+4)\,K_{v,4} - \ldots\ldots + (-1)^s\,\frac{\frac{1}{2}\cdot\frac{3}{2}\cdot\frac{5}{2}\cdots\frac{2s-1}{2}}{\Gamma(v+2s+1)}\,(v+2s)\,K_{v,\,2s}\right]$$

When v is made to take the special value $\frac{1}{2}$, we get the following expansion for $\sin^{2s}\theta$ in zonal harmonics of the first kind:

$$\sin^{2s}\theta = 2^s\,.\,s!\left[\frac{1}{1.3.5\ldots 2s+1}\,.P_o - \frac{1}{3.5.7\ldots 2s+3}\,.s.5\,P_2 + \frac{1}{5.7.9\ldots 2s+5}\cdot\frac{s(s-1)}{2!}\,.\,9\,P_4 - \ldots\right].$$

The special case $s=2$, namely

$$\sin^4\theta = \frac{8}{15}P_o - \frac{16}{21}P_2 + \frac{8}{35}P_4$$

is given as an example at the end of Ferrers's Treatise on Spherical Harmonics, but without any indication as to the law of the coefficients.

Transactions of The Royal Society of Canada
SECTION IV

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On the Systematic Position of Haplobothrium globuliforme Cooper.

By A. R. COOPER, M.A., Biological Department, University of Toronto.

Presented by Dr. J. J. MACKENZIE.

(Read May 26, 1914.)

In endeavouring to locate this new genus of cestode in the most recent classification of the Pseudophyllidea by Luehe ('02) such difficulty was encountered that it was considered advisable to discuss its relationships somewhat at length with the view to showing the necessity of a modification of the classification in order to accommodate such a most interesting form.

Before proceeding, the characters of the genus and species, of which a detailed description is soon to appear, will be given in brief for the purpose of immediate reference:

Genus: ***Haplobothrium*** Cooper ('απλόος, simple; βοθρίον, a small hollow or trench).

Scolex apparently unarmed, although the edges of the terminal disc and auricular appendages of both scolex and anterior proglottides are provided with very minute spines. Bothria, two shallow depressions on the dorsal and ventral surfaces, very simple in structure. Neck absent, proglottidation beginning immediately behind the scolex, but present in the anterior end only of the stobila, the hinder portion being quite ligulate. Foremost joints, long and narrow, provided with appendages which disappear farther back. Nervous system consists of two chief strands situated in the medullary parenchyma outside of the vitelline follicles, uniting anteriorly to form a very small nerve-ring, and eight collateral strands, four arranged around each main tract, the latter in the jointed portion of the strobila only. Excoretory system is made up of one larger median vessel, slightly dorsally situated, and two smaller, lateral and ventral, all uniting in the scolex behind the nerve-ring to form a median vesicle. Genital organs simple. Genital pores on the ventral surface, that of the vagina close behind the cirrus-opening towards the anterior end of the proglottis; opening of the uterus much farther back, a temporary aperture only. No genital atrium or cloaca. Ovary and shell-gland median, respectively ventral and dorsal. Vitelline glands composed of numerous follicles arranged cylindrically around the testes, both within the longtiudinal muscles of the parenchyma. Large vitelline reservoir. Testes all in one plane, separated into two regions by the median excretory vessel. Vitelline glands and testes laterally situated opposite the genital ducts, thus leaving a clear "middle-field." Vas-deferens provided with a sperm-reservoir at its posterior end near the middle of the proglottis; whole course of the duct dorsal to the uterine

sac; a large, almost spherical vesicula seminalis immediately postero-dorsal to the cirrus-pouch. Latter spheroidal in shape, simple in structure' containing "ductus ejaculatorius," a second vesicula seminalis and a cirrus lined with cuticle provided with small stout spines and a series of circular muscles. Vagina courses ventrally and expands within the "generative space" to form a well-developed receptaculum seminis, sharply separated from the very small and short continuation (the spermaduct) which unites with the oviduct to form the fertilization-duct ("Befruchtungsgang"). Sphincter vaginae and oocapt present. Uterus divided into two portions, a much-coiled proximal thin-walled tube, the uterine-tube ("Uteringang") and a large uterine-sac ("Utershöhle") which when gravid occupies almost the whole of the middle of the proglottis. Eggs with opercula. Life history as yet unknown.

Species: ***globuliforme*** Cooper, (*globulus*, a bead; *forma*, shape or form).

With the characters of the genus. See more detailed description to appear later. Habitat: Pyloric portion of the intestine of *Amia calva*, L.

From the foregoing description one would be inclined to place the worm in the family, Dibothriocephalidae Luehe 1902, of the order, Pseudophyllidea Carus. In fact the arrangement of the reproductive organs, excepting the uterus, strongly resembles, on the whole, those of *Dibothriocephalus latus* Linn. as described by Sommer and Landois ('72). Luehe ('02) has indicated that the following are important characters of the family: "Cirrus unbestachelt, mit zerklüfteter Cuticula........Die beiden Flächen der Proglottidenkette (abgesehen von den Genitalöffnungen) gleichgestaltet. Receptaculum seminis gebildet von einer lokalen Erweiterung der Vagina nahe deren inneren Ende, welche in der Regel gegen den Samengang (Endabschnitt der Vagina) scharf abgegrenzt ist......Eier mit Deckel ähnlich den Eier der Fascioliden." The uterus, on the other hand, is described as: "ein langer, mehr oder weniger stark gewundener Kanal, häufig in der sogenannten Rosettenform, kann lokal mehr oder weniger stark erweitert sein, bildet jedoch niemals eine 'Uterushöhle,' welche als einheitlicher Hohlraum den grössten Teil des Querschnittes reifer Proglottiden einnimmt." Apparent exceptions to this description of the uterus are seen in *Scyphocephalus* Riggb. and *Bothridium* Blainv., but in these genera there is no true division into a uterine tube and a uterine sac, the large cavity distended with eggs, especially in the latter, being composed of the coils ("Rosettenform") which are more distinct in earlier stages. Thus *Haplobothrium*, in spite of its resemblance in many other respects to a few genera of the sub-family Dibothriocephalinae Luehe, differs in two very important points from the members of the Dibothriocephalidae, viz., the cirrus is provided with minute yet distinct and numerous spines, and the uterus is divided into two definite portions, a uterine tube and a uterine cavity. Some readers may be inclined to think that this

division is merely a secondary one due to the distension of perhaps the most distal coil of a "Rosettenform" condition. This is, however, not the case, as will be seen by reference to the more detailed description of the species, where it is emphatically stated that the two divisions are quite distinct from the earliest stages, i.e., soon after they are differentiated from the anlage. In fact the uterine tube opens into the postero-dorsal region of the sac immediately above the temporary uterine-opening by a distinct aperture, which relations hold for adult and gravid conditions of the organ in spite of the thin walls and consequent difficulty in following the structures in serial sections. As regards the fact that the cirrus is armed with minute spines or short bristles, this species would seem to be related to the Amphitretidae Luehe; however, apart from the resemblance between the minute deeply-staining granules, to which the spines seem to be related, and the heads of the spines in the latter family (Luehe '02, p. 330) it is widely separated from this somewhat isolated group of genera. Thus the uterus is the only organ the division of which, into two distinct portions, would seem to exclude it from the Dibothriocephalidae and place it among the genera of the Ptychobothriidae, Luehe. Luehe, by the way, does not emphasize his statement that the: "Uterus nie die sogenannte Rosettenform annehmend, wohl aber in der Regel eine geräumige Uterushöhle bildend, welche die übrige Genitalorgane, ohne dass freilich deren Rückbildung eintritt, buchstäblich an die Wand drängen kann, in dem die ganze Proglottis in reifen Proglottiden vielfach als ein einziger sackförmiger Eibehälter mit verhältnismässig sehr dünnen Wandung erscheint," doubtless since in the genera *Ptychobothrium* Lonnbg. and *Taphrobothrium* Luehe the uterus is only a long winding canal without an enlarged cavity. As a matter of fact the whole question of the division of the uterus into distinct regions is one concerning which we cannot come to any definite conclusions since, to my knowledge, there is no adequate description of the developmental relationships between the uterine tube and the uterine sac in those genera in which they appear. This is quite applicable to the genus *Triaenophorus*, in the adult joints of which a sort of uterine sac appears, since Schmidt ('88) says only that: "das stumpfe, abgerundete Ende (of the uterus) steht mit dem Eileiter in verbindung, während das Spitze der Aussenflache des Körpers zuwuchert."

Consequently, it is perhaps advisable to place *Haplobothrium* at least temporarily in the family Dibothriocephalidae Luehe.

The scolex is closely related to the genera of the sub-family Triaenophorinae Luehe, 1899, in that it is provided with a terminal disc ("Scheitelplatte") armed with very small spines comparable to the variable spines on the same structure in *Ancistrocephalus micro-*

cephalus (Rud.) and provided internally with a series of longitudinally arcuate fibres arranged in quite the same way as those actuating the four sets of hooks in the scolex of *Triaenophorus nodulosus* (Pall.). Furthermore the vitelline follicles are situated in the medullary parenchyma ("Markschicht") as in *Ancistrocephalus* Montic., 1890, and *Anonchocephalus* Luehe, 1902. The testes resemble those of *Triaenophorus* in that they fill up the whole of the medulla. In other respects the genus belongs to the sub-family Dibothriocephalinae Luehe, as mentioned above. The excretory system is, however, considerably specialized since instead of the usual pair of dorsal vessels there is only one, situated in the median line and much larger than the other two placed more ventrally and laterally. In the possession of a second vesicula seminalis within the cirrus-pouch this genus does not differ from many genera of the family Dibothriocephalidae in which such an enlargement of the vas deferens appears (Luehe, '99 and '00).

But perhaps the most interesting feature of this genus is the division into proglottides in the anterior end of the strobila only (apart from the sets of reproductive organs in the unsegmented portion). This is chiefly expressed by and apparently due to the prolongation of the hinder end of the proglottis into four auricular appendages, symetrically situated, which gradually diminish in size until they disappear at about the twenty-fourth joint. Thus they seem to function in relation to the anterior end of the strobila. They are provided with a well-developed musculature which is arranged so that the very border or tip of the structure can very readily be made to come in contact with the substratum. Furthermore, not only the borders of the appendages of the scolex and foremost joints but those of the terminal disc as well are provided with bands of minute hook-like spines, as mentioned above, directed towards the median axis of the strobila, which are surely effective upon the moist mucous lining of the host's intestine. Thus it would seem that the appendages are secondarily specialized in the anterior end of the worm as important accessory organs of attachment, the very simple bothria differing little externally and internally from the foremost proglottides. The rest of the strobila has probably lost its external indications of proglottidation and returned to a primitive condition comparable to that seen in *Ligula*.

On the whole the systematic position of *Haplobothrium globuliforme* seems to be not only an unique but somewhat isolated one recalling that of the host, *Amia calva* Linn. which is of great interest to students of ichthyology.

I wish to here express my indebtedness to the Biological Board of Canada and the University of Toronto who, by placing extensive facilities and material at my disposal, have made it possible to carry on these researches in helminthology.

Biological Department,
University of Toronto,
May 22, 1914.

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The Distribution of Iodine in Plant and Animal Tissues.

By A. T. CAMERON.

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(Presented by Professor SWALE VINCENT, F.R.S.C.)

(Read May 26, 1914.)

From a biological standpoint the two facts of paramount importance in the history of iodine are the discovery of the element itself in sea-weed in 1811 by Courtois, and the discovery of its presence in the thyroid gland by Baumann in 1885. Subsequent to this date investigations have been directed chiefly with the aim of discovering the function, if any, of iodine in the thyroid. A very large number of papers have appeared, whose chief result seems to be to throw into doubt all the earlier conclusions derived from the work of Baumann and his followers (as for example that the iodine of the thyroid is present organically combined in a relatively simple compound "iodothyrin," to which is due the activity of the gland as a secretory organ), without presenting a more defensible theory.[1]

Various conflicting statements have been put forward as to the presence or absence of iodine in other mammalian tissues, especially those of the glands of internal secretion. More definite data are available for certain invertebrates. Thus the presence of iodine in Sponges was discovered by Fyfe in 1819, and confirmed by numerous investigators,[2] while Drechsel first pointed out its presence in corals.[3] Numerous investigations have shown that it is present in almost all Sea-weeds.

The fact that when a diet rich in iodine is administered to an animal such as the dog, the iodine content of the thyroid is markedly and rapidly increased, was pointed out by Baumann himself,[4] and has been repeatedly confirmed. The known variations of iodine

[1] See in this connection, Swale Vincent "Internal Secretion and the Ductless Glands," Arnold, London, 1912, p. 311, and Biedl, "Innere Sekretion" 2te Aufg., Bd. 1, S. 211.

[2] Cp. Harnach, *Munch, med. Wochenschr., 43*, 196.

[3] *Z. Biol., 33*, 85, 1896.

[4] Baumann and Goldmann, *Munch, med. Wochenschr, 43*, 1153, 1896.

content of the gland in different species of animals (as distinct from the marked individual variations which occur in the same species) were attributed to this cause by Roos,[1] and the theory is usually accepted that the diet of an animal is the determining factor of the amount of iodine in its thyroid. Reasoning from this I was led to examine the thyroids of certain elasmobranch fishes, since these existing in a medium containing iodine in distinct amount, should show high figures for the iodine content of the thyroid if the theory were correct. I found[2] that iodine was present in marked amount, and, for the female dog-fish, *Scyllium canicula*, obtained a value higher than any previously recorded. These results suggested the desirability of examining the various forms of sea-life in greater detail. The examination of the iodine compounds in Sponges and Corals, leading to the definite identification of 3, 5-di-iods-l-tyrosine as one of the forms in which iodine is linked in organic tissue[3] and not improbably in the thyroid itself,[4] indicated that further light might be thrown on the problem of the form or forms in which iodine is held in living tissue, by an investigation over a wider field.

With the permission of the Biological Board of Canada I was able to collect material at their Pacific Coast Station at Nanaimo, B.C. I obtained a large number of specimens of different species of Algae, and specimens of representative species of most of the animal phyla. The selection of the latter was made more or less at random, and analysis of different tissues examined was also not systematic; the investigation undertaken was more or less preliminary, with the purpose of indicating the direction for further work. Complete examination of the tissues of the dog fish *Squalus sucklii* was carried out. I have employed Hunter's method throughout.[5] Since most of the results of previous observers have been obtained by the use of Baumann's method of analysis,[6] or of some modification of it, and since there is considerable evidence that this method frequently yields too small values, and does not detect small amounts,[7] it seemed desirable to carry out a systematic examination of ordinary mammalian tissue. I have done this for the dog and the rabbit.

The details of the analyses will be published elsewhere, and in this paper I shall only give a resumé of my results. They are all expressed for dry tissues (dried at 100° C. to constant weight).

[1] *Zeitschr. f. physiol. Chem.*, *28*, 40, 1899.

[2] *Biochem, J.*, *7*, 466, 1913.

[3] See for example Wheeler and Mendel, *J. Biol. Chem.*, *7*, 1, 1909; Mörner, *Zeitschr. f. physiol. Chem.*, *51*, 33, 1907; *55*, 77, 223, 1908.

[4] Compare for example Oswald, *ibid.*, *62*, 432, 1909.

[5] *J. Biol. Chem.*, *7*, 321, 1910.

[6] See Baumann and Roos, *Zeitschr. f. physiol. Chem.*, *21*, 489, 1895.

[7] I have discussed this evidence previously. See *J. Biol. Chem.*, *16*, 465, 1914.

Green, brown, and red Algae have been examined, and in all species examined iodine has been found, the amounts varying from 0·002 to 0·2 per cent. The highest values were obtained with Laminaria, in agreement with the results of other observers. A number of analyses on the different parts of *Nereocystis lütkeana* (leaves, float, stipe, holdfast) showed marked differences, but in no definite direction, indicating no specific distribution of iodine in the plant. Further analyses will be carried out to test this point further.

Six specimens of Sponges all gave positive results, the actual figures varying between 0·009 and 0·019 per cent. These are of a lower order than those usually recorded.

Of the Coelenterata, a hydroid, *Obelia longissima*, contained 0·013 per cent. Negative results (0·000 per cent.) were obtained for jelly-fish, sea-anemones, and comb-jellies. There are no corals obtainable in the Nanaimo district.

Very interesting results were obtained with Annelid worms. The dry tissue of four species contained amounts of iodine varying from 0·008 to 0·039 per cent, The worm-tubes contained much larger amounts. The calcareous tubes of a Serpulid worm contained 0·030 per cent. After removal of the calcium carbonate, analysis indicated that the organic residue contained at least 0·7 per cent.

A *Diopatra* worm contained 0·023 per cent. The inner layers of its horny tube 0·4 and the outer layers 0·26 per cent. These tissues will be examined further.

A species of Bryozoa, *Bugula flabellata*, contained 0·016 per cent.

The different tissues of sea-urchins showed the presence of traces of iodine. Differentiation was distinctly observable, the test, spines, and hard part of Aristotle's Lantern containing none, and the internal organs amounts of the order 0·05 per cent. Doubtful results were obtained for the sea-cucumber, and negative results for starfishes.

Crustaceans contain only minute amounts of iodine.

Pelecypods contain distinct traces. The horse-clam *Schizothoerus nuttalli* was examined in some detail. Most of the tissues gave negative results, but the outer cuticle of the foot was found to contain 0·298 per cent.

The test of the tunicate *Pyura haustor* was found to contain 0·200 per cent. Insufficient material was obtained to carry out accurate analyses of the remaining tissues.

The tissues of the dog-fish *Squalus sucklii* were examined in detail Positive results were obtained only with the thyroid (0·2 per cent.), kidney (0·003 per cent.) and liver (trace).

Systematic analyses of all the tissues of the rabbit and the dog gave negative results except for the thyroid.

The thymus has been examined for a number of species (pigeon, brown rat, albino rat, guinea-pig, rabbit, cat, dog, man) with consistent negative results, in agreement with previous results of Cunningham[1] and Mendel.[2]

Examination of these fresh data, and comparison of them with the large number of analyses previously published by other observers, lead to the following conclusions:—

(1) Iodine is an almost invariable constituent of all organisms, plant and animal, the amount present depending on the diet and medium of the organism.

(2) With greater development there is greater specificity of the tissue concerned in storing iodine, until in vertebrates no tissue except thyroid contains appreciable quantities.

(3) All normal thyroids contain iodine, the amount varying with the diet, and between the limits 0·01 and 1·1 per cent. (dry tissue).

(4) Besides the skeletal tissues of Sponges and Corals, three additional types of tissue have been found, which contain iodine in quantities comparable with those in thyroids, the horny tubes of Eunicid worms, the external cutaneous tissue of the "foot" of the horse-clam, and the test of a tunicate.

I wish to acknowledge my grateful indebtedness to Dr. Maclean Fraser, the Curator of the Nanaimo Biological Station, for his uniform kindness in assisting me in the work of collection and identification of the material described in this paper, to thank Mr. F. S. Collins for kindly identifying a number of algae for me, and to thank Professors Swale, Vincent and Buller for their interest and encouragement in the course of the work.

The expenses incurred in the collection and preservation of the Nanaimo material were defrayed by grants from the Biological Board of the Dominion. The remaining expenses have been defrayed by grants through the Ducltess Glands Committee of the British Association for the Advancement of Science, and (through Professor Vincent) from the Royal Society of London.

The work forms part of researches carried out under the direction of the Ductless Glands Committee of the British Association.

[1] *J. Exp. med.*, *3*, 231, footnote, 1898.

[2] *Amer. J. physiol.*, *3*, 285, 1900.

*On new species of Aspideretes from the Belly River formation of Alberta, with further information regarding the structure of the carapace of Boremys pulchra.**

By LAWRENCE M. LAMBE, F.G.S., F.R.S.C., F.G.S.A., Vertebrate Palæontologist to the Geological Survey, Canada.

(Read May 26, 1914.)

A well preserved carapace of a turtle, belonging to the genus Aspideretes, family Trionychidæ, forms part of the Geological Survey collection of vertebrates of 1913 from the Belly River formation on Red Deer river, Alberta. All the bones which formed the shell are intact and the sutures are very distinctly marked. The species is apparently undescribed, and for it the name *subquadratus* is proposed.

The carapace is somewhat quadrangular, and broader than long. In front and behind the outline is concave, laterally it is flattened, and becomes broadly angular on each side of the anterior and posterior emarginations.

The matrix, a sandy clay, has not yet been removed from the lower surface of the shell so that the present description will be confined to the upper exposed part only.

As the specimen now is, and it does not appear to be abnormally flattened, or crushed, it is transversely convex with a sudden deflection of the lateral border most pronounced at the middle of the sides. In a longitudinal direction the shell is nearly flat with a slight inclination upward in advance of the first neural bone; the front and back margins are acutely rounded. The maximum elevation of the shell above the lowest part of the lateral downturned edge is about 29 mm. The length of the carapace at the mid-line is 201 mm., and the greatest breadth 225 mm.

In the mid-line are seven neural bones, preceded by a short preneural. The costal bones number eight.

The preneural is four-sided, broader than long, and broadest in front. The first four neurals are six-sided, longer than broad, with two postero-lateral short sides, at the front end of which the bone is broadest. The preneural and the first and second neurals have about the same breadth. The second neural is the longest. The fifth and sixth are slightly irregular in shape, and longer than broad.

*Communicated by permission of the Director of the Geological Survey.

The fifth is broadest behind with one postero-lateral short side, the sixth is broadest in front where there is a short antero-lateral side. The seventh neural is irregularly shield-shaped, with the pointed end behind. The sizes of these bones are given in mm. in the accompanying table:—

Bone.	*Length.*	*Breadth.*
Preneural	13	19
Neural 1	22	19
Neural 2	27	18
Neural 3	25	17
Neural 4	25	15
Neural 5	20	11
Neural 6	18	10
Neural 7	13	10

Of the costal bones the first is the broadest (fore and aft) at mid-length The second, third, fourth, and fifth have about the same breadth at mid-length, the second and fifth attaining a greater breadth distally than the other two. The eighth pair meet along the mid-line for a distance of 19 mm., and have a posterior free border which is considerably longer than their breadth (fore and aft). The seventh pair of costals meet at the mid-line behind the seventh neural. The preneural and the anterior two-thirds of the first neural lie between the first pair of costals.

The sculpture of the carapace of this species consists of a shallowly pitted surface in the neurals and at the inner end of the costals. Passing outward on the costals the pits become larger, and lengthened in a fore and aft direction by coalescence. Toward the distal end of the bones the coalescence becomes more pronounced and results in tortuous grooves of varying length, transverse to the length of the bone The grooves are separated by narrow, frequently inosculating, sinuous ridges whose breadth is much less than the width of the enclosed sunken areas.

The presence of the preneural bone, in combination with its other structural characters, clearly indicates the generic relationship of this specimen. In no described species of the genus Aspideretes is there the same assemblage of characters as is found in the outline of the carapace, the size, shape and proportions of the seven neural bones, the nuchal bone, and the posterior costals of this specimen.

In some forms of Amyda the sculpture of the carapace closely resembles that of certain species of Aspideretes. Generally the

sculpture in these closely allied genera does not afford sufficiently reliable data for a specific determination when the material is fragmentary.

The above carapace, the type of *Aspideretes subquadratus*, was found by George F. Sternberg of the vertebrate palæontological collecting party of 1913.

In 1902* the writer described an almost complete carapace of a turtle from the Belly River formation on Red Deer river in Alberta, and referred it to Leidy's species *Trionyx foveatus* from the vicinity of Judith river, Montana, U.S.A. In making this determination the writer was influenced by the sculpture of the proximal half of the costal bone which with other shell fragments, constitute the type material of Leidy's species. It is probable that this Trionyx (*Aspideretes of Hay*) from the Belly River formation of Alberta is distinct from Leidy's species which is not determinable generically. For this turtle, therefore, from the Belly River formation the new specific name *maturus* is proposed to distinguish it from the form from the vicinity of Judith river, Montana. The name *maturus* is intended to convey not only the idea of an early appearance in Cretaceous time but also an attainment of general structural characters maintained by the Trionychidæ with little change through later forms to existing species. *Aspideretes maturus* differs from *A. subquadratus* principally in the shape of the carapace, the number, form and proportions of the neural bones, and the shape and proportionate size of the posterior costals.

One of the principal distinguishing characters of the Belly River Cretaceous Amphichelydian genus Boremys of the family Baënidæ is the presence in the carapace of supramarginal scutes. In common with other genera of Baënidæ imframarginals occur in the plastron.

Boremys pulchra† was described by the writer from material which he collected in 1898 and 1901 in the Belly River formation on Red Deer river, Alberta. In the type specimen the plastron was complete but the hinder half of the carapace was missing. Another specimen, consisting of the carapace only, supplied valuable information regarding the number, shape and disposition of the horny scutes but in it most of the sutures between the bones could not be traced.

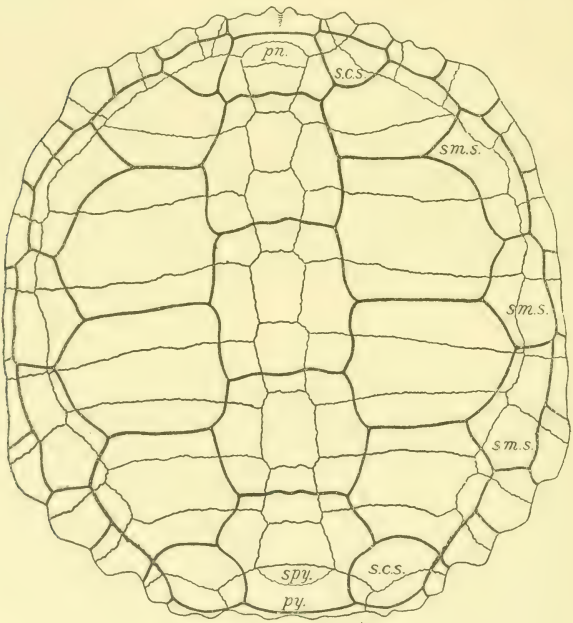
*Geol. Survey, Canada, Summary Report for 1901; Contributions to Canadian Palæontology, Vol. III (quarto), Part II.

†Contributions to Canadian Palæontology, Vol. III (quarto), Pt. II, p. 43, fig. 8, 1902; Ottawa Naturalist, Vol. XIX, No. 10, January, and No. 12, March, 1906.

Included in the collection of 1913, from the Belly River formation at the type locality, is a complete shell of this species in which the structure and form, in both plastron and carapace, are well preserved, supplying the deficiencies of the material hitherto available. This interesting specimen was discovered by L. Sternberg of the collecting party of last summer, and corresponds almost exactly in size with the type.

The following general description of the carapace of this species, with more particular reference to its hinder half is now given.

The carapace is nearly as broad as long, and is broadest in its hinder half. The margin in front is sinuous and rather flatly curved; postero-laterally it is scalloped, and narrowing rather rapidly backward, is flattened behind. The upper surface is moderately arched.



Carapace of Boremys pulchra, Lambe.
One-half the natural size.

S.C.S., supernumerary costal scute; *SM.S.*, supramarginal scute; *pn.*, preneural bone; *py.*, pygal bone; *spy.*, suprapygal bone.

The peripheral edge is sharply rounded where free, becoming thinner and more acute where it is scalloped; at the bridges there is a decided angulation.

The shell is sculptured in a conspicuous manner by a combination of nodes and ridges. In the longitudinal mid-line there is a ridge along the length of the neural bones. In the more anterior neurals this ridge may become double with minor oblique ridges and grooves on each side. Slightly behind the centre of each of the four larger costal scute areas there is a node, or swelling, from which radiate well-marked ridges which tend to become nodular or elevated where they terminate. Other minor swellings occur along the front peripheral margin, and near the margin laterally and posteriorly. This sculpture pattern is definite and gives an undulatory surface to the carapace.

The carapace is composed of the following bones:—in the mid-line, the nuchal, a preneural, eight neurals, a suprapygal, and pygal; on each side, eight costals; on the periphery, twelve marginals to each side. The horny shields or scutes, as indicated by the grooves, or sulci, were as follows:—in the central line, the nuchal scute and five vertebrals; to each side, four large costal scutes with a small supernumerary costal in front, and a small posterior one, making twelve costals in all; eleven marginal scutes on each side, and between the larger costals and the marginals three supramarginals of fair size.

The nuchal bone is three times as broad as long, and is excavated behind for the reception of the anterior edge of the preneural. This latter is half as broad as the nuchal, and short from front to back. The first neural is four sided and broadest in front. The second, third, fourth and fifth neurals have six sides of which the two antero-lateral ones are short; their greatest breadth is far forward at the back termination of the short sides. The sixth neural is eight-sided with four short sides of which two are antero-lateral and two postero-lateral. The seventh neural is six-sided with two postero-lateral short sides. The eighth neural is four-sided and broadest behind. The suprapygal is lenticular in outline, of the same breadth as the eighth neural, and three times as broad as long. The pygal is more than three times as broad as long, and twice the breadth of the suprapygal which is received into an emargination of the front border of the former bone.

Of the eight costal bones the first is irregularly triangular, the second, third, fourth, sixth and seventh increase in breadth (fore and aft) distally, the fifth narrows to its distal end, and the eighth is of irregular shape.

The marginal bones are mostly subquadrangular in shape; there is little difference in their length but they vary considerably

in breadth according to their position on the periphery. In the front half of the carapace they are longer than broad with the exception of the first which is triangular and very small. The eighth, ninth and tenth are broader than long; in the eleventh and twelfth the reverse is the case.

The reader is referred to the accompanying figure for a general idea of the shape of the carapace as well as for the relative size and disposition of the bones and scutes.

Of the vertebral scutes the first is nearly twice as broad as long, in the second the length and breadth are about equal, in the third the length slightly exceeds the breadth, and the fourth and fifth are broader than long. Their transverse sulci cross the first, third, fifth and seventh neural bones. The breadth of the nuchal scute is about four times its length.

The four larger costal scutes are all broader than long notwithstanding the intervention of the three supramarginals between them and the marginals. The presence of additional costal scutes, one in advance of the first costal, the other behind the fourth, lessens the length principally of the first and fourth scutes. The anterior supernumerary costal is somewhat triangular in shape, the posterior one is irregularly oval, or sub-circular.

The three supramarginal scutes are long in comparison with their breadth, and are in a row, alternating with the costal scutes, between them and the marginals.

The marginal scutes are all longer than broad. Those which bound the supramarginals outwardly are noticeably reduced in breadth, the largest being the third and the ninth, in advance of the first supramarginal and posterior to the third respectively. The inner sulcus of the tenth marginal scute overlies, or corresponds in direction with, the suture between the eleventh marginal and eighth costal bones.

The space occupied by the supramarginal scutes seems to have affected the breadth of the marginal scutes to a greater extent than it has that of the vertebral and costal scutes. The presence of supramarginals probably accounts to some extent for the breadth of the carapace in comparison with its length.

The carapace of *Boremys pulchra* is remarkable for the presence in it, on each side, of three supramarginal scutes, and two supernumerary costal scutes. The suprapygal bone between the eighth neural and the pygal repeats posteriorly what is found anteriorly, viz., the intervention of the preneural between the first neural and the nuchal. In front there is the separation of the preneural from the first neural, and posteriorly the suprapygal from the eighth neural. Attention is again directed to the sculpture of the carapace.

*Description of a new species of Platysomus from the neighbourhood of Banff, Alberta.**

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(Read May 26, 1914.)

An excellently preserved specimen of a species of Platysomus, from rocks of presumably Permian age near Banff, Alberta, has lately been received by the Geological Survey. This fossil fish was found by E. W. Peyto of Banff in 1912 and was sent to the Geological Survey, for description, by N. B. Sanson, curator of the Banff Museum. The writer wishes to express his obligations to Mr. Sanson for the opportunity thus afforded of studying so fine a specimen.

The fish is remarkable for its size, and although the head has suffered from weathering and the elements composing it are not distinguishable, the remainder of the specimen gives details of structure which largely make up for the deficiencies of the anterior part.

As the species represented is apparently undescribed the following particulars of its structure are given, and, as it is the first member of the Platysomidæ known from Canada, the specific name *canadensis* is considered appropriate.

The general shape is that of a short rhomboid ending in a deeply cleft, nearly symmetrical tail. The angles of the rhomboid are the highest and lowest points of the body contour, the mouth, and the base of the tail. The dorsal angulation is in advance of the mid-length of the body, while the ventral angulation is slightly behind it. The outline from the upper and lower angulations backward to the tail form two remarkably straight, converging lines.

The trunk has a maximum height almost equal to its length measured from the pectoral arch to the slender caudal pedicle. The contour is perfect from the anterior end of the dorsal fin backward to include the tail and forward beneath to the front end of the anal fin. From the mouth to the dorsal fin the exact outline is not preserved, and between the anal fin and the mouth there is, without doubt, some distortion.

The dorsal fin, extending from the upper angulation to the base of the tail, is slightly elevated in front, decreasing gradually in height

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for half its length and thence continuing backward at about one-third its maximum anterior elevation. The anal fin extends from the ventral angulation to the caudal pedicle. Anteriorly it is very deep, pointed below and recurved, narrowing rapidly backward to form a fringe similar in shape to the posterior half of the dorsal fin. The curved anterior margin of the anal fin is three times greater than the front elevation of the dorsal fin.

The characters of the species may be summarized as follows:—Fish large, laterally compressed, with a maximum depth equal to three-fifths of its total length; dorsal and ventral margins angulated, the upper angulation nearer to the mouth than to the caudal pedicle, the lower one farther back. Dorsal and anal fins extending from the upper and lower angulations respectively to the caudal pedicle. Anterior end of anal fin acuminate and much extended. Caudal fin deeply cleft, equilobate; its pedicle slender. Pectoral fin small and placed high above the ventral margin. No fulcra on the fins. Scale ornamentation minutely pustulose. Flank-scales rhomboidal, much deeper than broad, with a large, anterior, fusiform inner keel. Scales near the posterior, ventral margin of the trunk, small, oval in outline; those on the upper caudal lobe small, diamond-shaped. Moderately large ridge-scales on the upper lobe of the tail; small ridge-scales in advance of the anal fin. Endoskeletal supports of the dorsal and anal fins short, about equal in number to the fin-rays.

The specimen occurs in a slab of very fine, dark grey, calcareous sandstone, about two inches thick, and lies, much flattened, in a bedding plane, at the mid-thickness of the slab, along which the rock has conveniently split, revealing the fish on the two surfaces thus exposed. All the fin-rays are preserved either on one surface or the other. When present on one surface their impression is left on the other. This is the case also with the small ridge-scales in front of the anal fin, but with the rhomboidal flank-scales, the small oval scales above the base of the anal fin, and the diamond-shaped scales of the upper lobe of the tail the plane of fracture lies between those of the right and left sides of the body exposing them from within. The ridge-scales of the upper caudal lobe have broken along their upper edge, so that their halves are on different sides of the cleavage plane and are also seen from within.

From the mode of preservation of the specimen, it follows, therefore, that an inner view only of the flank-scales is presented. Their inner surface, as was to be expected, is smooth. By lifting fragments of these scales the exterior sculpture is seen as well as its impression in the rock. The sculpture consists of minute, closely set pustules which shew a tendency to coalesce and form short, twisted or ver-

micular raised markings. The outer surface of some of the bones of the head, seen in fragments or as impressions, have a similar sculpture but slightly rougher with a greater development of the vermiculations.

In the upper flank-scales (figured) the height is more than twice the breadth. The flank-scales lower in the trunk are larger, but proportionately narrower, the height in them being three times the breadth.

The upper margin of the flank-scales is prolonged upward in front by a prominent, inner, fusiform ridge which extends along the slightly curved anterior border. The upper end of the anterior ridge passes behind the lower end of the ridge of the scale immediately above. The entire outline of any one flank-scale has not been observed as all the scales are in place and consequently the lower end and posterior margin of each scale are hidden by the overlap (or more properly the underlap as the scales are viewed from within).

Upper flank-scales of Platysomus canadensis;
inner surface; natural size.

The upper flank-scales present the appearance shewn in the accompanying text-figure. The upper projecting ridge-end, or peg,

was probably received in a socket or depression in the scale next above in the vertical series. The specimen, however, is so flattened by extreme pressure that much of the relief of the inner scale surface is lost. The upper and front margins of the scales can be traced with the aid of a lens and the vertical ridges, though flattened, are conspicuous.

The overlapping ridge-scales of the upper lobe of the tail decrease rapidly in size from the caudal pedicle backward to near the extremity of the lobe. In the specimen the end of the upper caudal lobe is missing but its outline is probably as indicated in the plate. These scales have broken along their longitudinal mid-line, as already explained, and are seen from within. They are crushed and broken and their exact outline is not seen but in general shape and disposition they agree with corresponding scales in members of the Platysomidæ and Palæoniscidæ. At about 15 mm. below the anterior upper margin of the tail their lower edge forms a well defined line which approaches the margin as the scales grow smaller posteriorly. In this basal line, behind the caudal pedicle, there are three scales represented in a space of 50 mm. Posteriorly four scales apparently occupy half that space.

The body prolongation in the upper caudal lobe narrows rapidly backward and ends some distance anterior to the back termination of the lobe. The scales covering the body prolongation are diamond-shaped with a length about four times their breadth (height). They are largest beneath the ridge-scales anteriorly where there are four in a space of 50 mm. In passing downward and backward on the body prolongation these scales become smaller, the decrease in size being especially marked in the hinder ones.

On a strip of the body surface above the long base of the anal fin, the large flank-scales are replaced by comparatively small oval scales with their longer diameter fore and aft. The area covered by these small sized scales is about 70 mm. broad at the lower body angulation, and it narrows gradually backward to the caudal pedicle, the size of the scales also diminishing. In front of the mid-length of this area there are two scales in a space of about 24 mm. measuring from front to back.

On approaching the dorsal margin of the body beneath the base of the dorsal fin the flank-scales diminish in size; they become narrower in proportion to their length and retain a well-developed anterior inner keel. Toward the ventral margin anterior to the anal fin, and near the dorsal margin in front of the dorsal fin a diminution in the size of these scales is not so apparent.

Small ventral ridge-scales are present in advance of the anal fin, seven of them occupying a space, in a fore and aft direction, of about 35 mm.

There seems to have been little or no ossification of the vertebral axis whose position, however, is clearly indicated from the back of the head to the caudal pedicle. The neural spines were apparently ossified to some extent and have left their imprint throughout the length of the column between the head and the tail. Near the head their distal ends are about 65 mm. above the axis of the column; in passing backward they gradually decrease in length and are less upright.

Fin-supports extend along the whole length of the base of the dorsal and anal fins, those of the former being somewhat shorter than those of the latter. In each series the number of supports is about equal to that of the dermal fin-rays. From their appearance in the specimen the supports were probably in a state of semi-ossification.

No indications of ribs are detected nor are hæmal spines seen except behind the caudal pedicle in the lower half of the base of the tail where apparently the spines are enlarged and support the fin-rays of the lower caudal lobe.

The ventral fins were probably small; no trace of them, however, is preserved. The pectoral fin is situated high on the body and there is no reason for supposing that it is much, if at all, out of place. Its position is indicated by a number of fin-rays which further shew that it was of small size; as the rays are not complete distally the outline of the fin is lost.

The fin-rays are articulated, and divide and subdivide at intervals in their length. In the anterior part of the anal fin the rays are particularly clear and distinct. In one of the rays here, which is 60 mm. in length, a division takes place at 16 mm. from the proximal end; further subdivision at rather irregular intervals results in sixteen slender filaments at the outer end. In other parts of the fin, and in the dorsal and caudal fins, the same general plan of fin-ray division is adhered to. In the lower caudal lobe near the inferior margin proximally the fin-rays are particularly robust strengthening the lower lobe as the body prolongation does the upper lobe. Fulcra are not present on the fins.

What may be impressions of small, knob-like teeth suggest a tritoral dentition. No other indications of teeth have been observed. The impressions occur a short distance back from the anterior end of the mouth opening and have an average diameter of 1 mm.; they are about their own diameter apart and are disposed in a rather irregular manner.

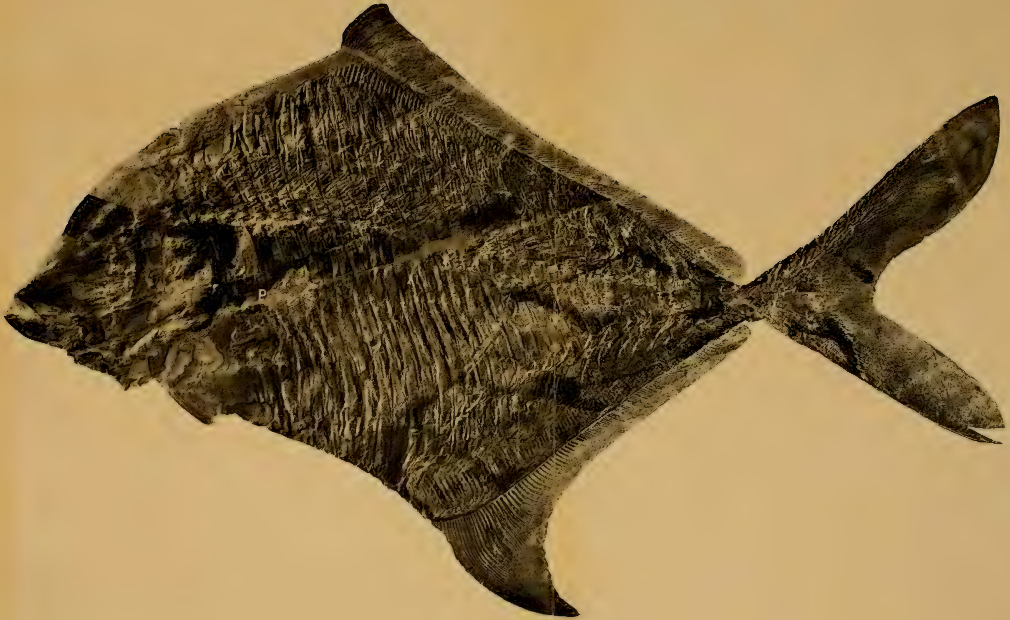
Platysomus canadensis differs from all other described species of the genus in its general proportions, as well as in details of structure. Its great size, far surpassing that of any known member of the family, and the basal length of the dorsal and anal fins are noteworthy. Its general outline is somewhat like that of the relatively small *P. gibbosus* (Blainville) from the Upper Permian of Germany and England. In both species there is a trunk-area, with small scales, above the base of the anal fin. The very small North American species which have been referred to this genus are from the Coal Measures of Illinois (Newberry and Worthen, and Cope) and the Permian of Indian Territory (Cope). The high position of the pectoral fin in the type, and only known specimen of *P. canadensis* is also a character to which attention is drawn.

MEASUREMENTS.	mm.
Length of specimen......3 feet, 8½ inches...............	1140
Length from anterior end to caudal peduncle.............	825
Height of specimen, including fins (vertical)...............	703
Height of specimen, excluding fins (vertical)	540
Spread of caudal fin, approx...........................	420
Height of caudal peduncle.............................	45
Length of dorsal fin at base...........................	525
Depth of anterior end of dorsal fin, approx...............	70
Depth of posterior end of dorsal fin......................	30
Length of anal fin at base.............................	420
Depth of anterior end of anal fin.........................	165
Depth of posterior end of anal fin........................	23
Height of flank-scales (figured) midway between dorsal angulation of body and vertebral column (approx).....	43
Breadth of same (approx.)............................	18
Height of flank-scales midway between vertebral column and ventral angulation of body (approx.)................	65
Breadth of same (approx.)............................	22
Number of articulations in fin-rays near base of anterior end of dorsal fin; 8 in space of..........................	10
Breadth of rays at same point.........................	2
Number of articulations in fin-rays near base of anterior end of anal fin; 6 in space of...........................	10
Breadth of rays at same point.........................	3

Number of articulations in fin-rays near lower margin of lower lobe of tail at 1-3 of its length from caudal peduncle; 4 in space of	mm. 10
Breadth of rays at same point	4
Length of anterior basal supports of dorsal fin (approx.)	45
Length of anterior basal supports of anal fin (approx.)	65

PLATE

Platysomus canadensis. Type; one-fifth natural size. *P.* indicates the position of the pectoral fin.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SECTION IV

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Observations on the Feeding Habits of the Stable Fly, Stomoxys calcitrans *L.*

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(Read May 27, 1914)

Collaterally with my studies on the House-fly, *Musca domestica*, observations have been made on the life-histories and bionomics of other Muscid flies, including the Stable-fly, *Stomoxys calcitrans* L. In view of the possible relationship of this common blood-sucking fly to poliomyetitis or infantile paralysis, suggested by the work of Brues, Rosenau, Anderson, Frost and others, some experiments were carried out in 1912 on the feeding habits of the fly, as little information was available at that time regarding these habits, which are of no little significance in the transmission of any micro-organisms. As pressure of other work has prevented me from continuing in the meantime these studies, and as I feel that in view of the possibility of *S. calcitrans* being a factor in the spread of pellagra, as the investigations of Jennings and King and the Thompson-McFadden Commission would appear to suggest, it is desirable that all such observations should be available, I am presenting them herewith in the hope that the facts set forth may be of use in studying the *rôle* of this insect as a disease-disseminator. I hope to publish a more complete account of my studies on the bionomics and life-history of *S. calcitrans* at a later date.

Several accounts of *Stomoxys calcitrans* have been published during the last year, among which should be mentioned the interesting work of Bishopp (1913), and the excellent account which Mitzmain (1913) gives of his studies which are the most complete up to date, with the exception of Portchinsky's valuable memoir (1910).

Method of Feeding.

Both sexes feed readily. In the experiments on which these observations are based the insects were fed, as a rule, on the back of my hand or arm, others were allowed to feed on a guinea pig in a cage

into which they were liberated. Although Mitzman (1913) found that the flies would take the initial bite six to eight hours after emerging from the pupa, I was unable, except in one case, to induce the flies selected for the purpose to take their first feed for at least twenty-four hours, although they were repeatedly placed on the skin. They usually fed readily between twenty-four and forty-eight hours after emergence.

The fly usually inserts the proboscis where it alights and does not waste time selecting a favourable place. Sometimes it will move the tip of the proboscis about a little on the chosen place. Under natural conditions no indication of their approach is given, and no notice would be taken of their presence except for the pain occasioned by the act of feeding. Indeed, the fly may not infrequently insert its proboscis and feed without the production of any noticeable sensation of pain; this depends upon the place of insertion and is, no doubt, governed by the local distribution of the peripheral nerve supply. Before inserting the proboscis the fly takes a firm "stance," to use a golfing term. The proboscis is then lowered from its normal horizontal to a vertical position, and driven into the skin. In the act of driving the proboscis into the skin there are two distinct movements. It is rapidly moved up and down and at the same time partially rotated from side to side through an angle of 180 degrees. While this main movement is taking place the labella at the distal end of the haustellum are exserted and the teeth they bear are performing the real cutting movement. Stephens and Newstead (1907), in their detailed description of the anatomy of the proboscis of *Stomoxys*, have very aptly compared this movement to that of a carpenter's auger with cutting flanges on either side, the only difference being that the movement in *Stomoxys* is not continuously rotating but from side to side. I was able to observe the action of the labella under the Zeiss binocular microscope by feeding *Stomoxys* on gelatin. The depth to which the proboscis is inserted varies and depends upon the thickness of the epidermis, that is, the nearness to the surface of the blood supply. Generally from one-third to one-half of the haustellum is inserted. I have observed the proboscis plunged to the depth of two-thirds of the labium, that is, to the swollen region, in a guinea pig's ear.

After the initial prick there occur occasional painful sensations during the operation of blood-sucking, which would otherwise be painless, as it sometimes is. In one case pain was experienced one minute and three minutes after insertion, in a meal of four minutes duration; in another case pain was experienced four minutes, six minutes and seven minutes after insertion in a meal of nine minutes.

The pain due to the blood-sucking operation is experienced apparently: first, when the wound is made, second when the fly is increasing the blood flow which it does after sucking a short time, and finally when or just before the proboscis is withdrawn. Only the haustellum and that portion of the rostrum below the palps take part in the rotatory movements. In some cases the proboscis may be in a deflected or twisted position during the whole meal; the apodemes attached to the base of the labrum are also twisted. The vibrating pharyngeal pump can be readily observed. During the whole period of feeding plunging movements of the proboscis are repeated.

The length of time occupied in feeding varied considerably. Undisturbed flies fed on the back of the hand fed from two to twenty-five minutes. In the latter case the fly withdrew its proboscis from the first puncture and immediately reinserted it in a new place. An average length of time occupied in feeding of twenty-two meals was 8·9 minutes when undisturbed.

During the feeding process, as the fly becomes gorged, convulsive movements of the abdomen occur and clear to slightly opaque drops of fluid in the case of a hungry fly, or brownish drops in the case of a fly which has not completely digested its previous meal, are forcibly ejected from the anus; in the female they are ejected from the upturned tip of the exserted ovipositor. In a fly which fed for 20 minutes, clear fluid drops were ejected from the anus at the following intervals after the fly had been feeding about $11\frac{1}{2}$ minutes: 1 min., 1 min., 1 min., 1 min., 50 secs., 100 secs., 1 min., 30 secs., 35 secs., 10 secs., the drops were ejected to a distance of about 5 mm. and all shot into the same drop of fluid. In another fly clear fluid drops were ejected after feeding five minutes at the following intervals; 15, 15, 45, 15, 10, 20, 25 seconds. When fully gorged the fly slowly withdraws the proboscis; slowly in order to take up as much as possible of the extravasated blood rising up the puncture. The place of insertion is always marked by a small drop of blood, and not infrequently the fly, after withdrawing its proboscis, will lower it again and sip the extravasated drop of blood; sometimes it will then plunge the proboscis into the old puncture for a further drink. Occasionally the fly will clean its head with its forelegs when fully gorged before withdrawing the proboscis. After the proboscis is withdrawn it invariably cleans its head and proboscis. The abdomen of the fully gorged fly is not only more than twice its usual depth, but is also about half as broad again as the normal breadth.

Period of Digestion.

After feeding the fly seeks a quiet corner and settles down, usually on a vertical surface with its body vertical and head upwards, its body being flattened against the surface upon which it is resting. In so short a time as half an hour after feeding the abdomen may almost have regained its normal size, though sometimes it remains swollen longer depending, no doubt, upon the length of time since the previous meal; a hungry fly will reduce the size of the crop or sucking stomach more rapidly than a fly whose digestive tract still contains food. In about two hours the red contents of the crop can no longer be seen externally.

The expulsion of clear fluid drops from the anus during the act of blood-sucking has already been described. This continues after the fly has ceased feeding. Upwards of a hundred drops may be expelled. In a few hours, however, the drops are no longer fluid and clear to opaque, but become viscid and clear in character. The number of such viscid faecal deposits expelled in the case of three flies was 34, 34 and 32. One fly expelled altogether 106 clear fluid and clear viscid spots within six hours of feeding.

The first appearance of digested food in the form of brown, faecal spots occurred, in the flies under observation, $3\frac{1}{2}$ hours after feeding. In the case of one fly undigested blood (human) was voided from the anus ten minutes after the fly had fed eight and one-half minutes, but this was evidently abnormal as the fly died shortly afterwards. The average interval, approximately, between the feeding and the first appearance in the faeces of digested blood was about six and one-quarter hours, in nine observations. The longest period observed was nine hours and fifty minutes.

The length of time occupied in the digestion of the whole meal varies, depending upon the quantity of blood taken. The willingness. of the flies to feed before the complete digestion of the previous meal rendered it not always possible to make exact observations in this point. The digestion of the meal before another feeding was permitted in ten instances and the time required for the digestion of a full meal varied from 49 hours 45 minutes to 95 hours; the average length of time was $72\frac{1}{2}$ hours. The completion of digestion was indicated by the cessation of the brown faecal spots and the voiding of clear faecal spots.

The rate of defaecation gradually decreases as the meal is digested. The accompanying Table shows the average number of brown faecal deposits and clear post-digestion deposits passed during each twelve hour period. The fly No. 8g. illustrates what I think may be taken as a typical case. It will be noticed that the greatest number of faecal

SUMMARY OF RESULTS OF EXPERIMENTS ON THE FEEDING OF *STOMOXYS CALCITRANS* L.

No. of Fly	No. of meal	No. of hours since previous meal	Nature of meal	Duration of feeding	No. of clear fluid spots counted	No. of clear viscid spots counted	Approx. time for commencement of passage of food through digestive tract	Average number of brown faecal deposits of digested blood and post-digestion deposits passed during each twelve hour period														Total No. of coloured faecal spots deposited meal before next meal	Approx. time for digestion of whole next where same was allowed hours.
								I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV		
								36	36	..	..	....		....		...		...		....		72	....
8b	1	....	human blood	2	....	....	....	20·4		..	..	...		....		...		...		....		31	....
	2	51	" "	8½	....	....	....	72	13·9	13·9	13·9	...		....		...		...		....		87	49¾
	3	18	" "	3	....	....	....	13·3	13·3	10	10	...		....		...		...		....		44	....
	4	50	Beef gelatin with nigrosin	1 1/60				....		....		...		....		...		...		....		......	....
	5	3½	human blood	4	....	....	....	....		....		...		....		...		...		....		......	....
	6	44½	" "	7	24 in. 20 mins.	....	3½ hrs.	20	20	26	7	12		....		...		...		....		83	50
	7	52½	" "	10	....	....	5 hrs.	10	12	12	7	2	7	....		...		...		....		56	....
	8	71¼	" "	5½	....	....	....	23·5	23·5	11	11	3		....		...		...		....		72	50
8c	1	....	human blood	5	....	....	....	....		....		...		....		...		...		....		....	....
	2	28	" "	6½	34	....	......	4	5	....		...		....		...		...		....		9	....
	3	20	" "	2	....	....	....	8	8	8	8	...		....		...		...		....		30	....
8f	1	....	human blood	2½	37	....	6 hrs.	14	14	7	7	6	5	1	1	...		...		....		54	....
8g	1	2	human blood	10	....	....	9½ hrs.	11	11	15	15	14	13	6	5	3	2	...		....		99	72
	2	123	" "	20	....	5	....	10	12	24	18	12	12	2	1	2	1	...		....		96	80
	3	114	" "	25	....	36	....	5	6	24	22	18	16	5	4	2	1	...		....		107	90
	4	121½	" "	16	....	32	....	16	18	23	12	5	10	12	11	...		...		....		108	72
	5	96	" "	14	....	....	....	....		....		...		....		...		...		....		......	....
8h	1	....	human blood	9	....	....	9 5/6 hrs.	7	8	9	9	7	6	2		...		...		....		49	....
	2	76	" "	17	....	....	....	13	12	8	7	5	3	3	2	...		...		....		52	84
	3	96¾	" "	9¾	....	10	7 to 8 hrs.	11	11	10	8	6	3	2	1	0	0	...		....		52	95
	4	113¼	" "	10½	....	24	5 to 6 hrs.	11	22	20	20	3	3	2	1	0	0	3	3	2	0	90	80*
8i	1	....	blood of guinea pig	4	151	....	4 to 6 hrs.	16	20	16	16	6 6		....		...		...		....		81	....
8m	1	....	blood of guinea pig			....	Under 6 hrs.	20	20	12	12	13·5 14		....		...		...		....		94	....
8n	1	....	human blood	8½	....	....	10 mins.																*Last meal lasted 170 hrs.

deposits are passed during the second 26-hour period, during which time, apparently, the meal is most actively digested.

The fact that the meal is chiefly digested during the first forty-eight hours, as indicated by the rate of defaecation, is supported by the volume of the faeces. Taking the diameter of the faecal spots as a measure of their comparative volume, it was found that during the first twenty-four hours after feeding the brown faecal deposits which are first passed when digestion begins had an average diameter of 1 mm. The subsequent dark-brown deposits passed during the same 24-hour period measured on the average ·77 to 1 mm. in diameter. The average diameter of the dark brown faecal deposits passed during the second 24-hour period after feeding was ·7mm., and the blackish-brown deposits of the third 24-hour period were uniformly ·5mm. in diameter.

Examination of faecal deposits.

A large compound faecal depoist, such as the flies frequently made when resting after a meal and defaecating in the same place, which has been passed between five and seventeen hours after feeding on human blood, was examined. It was dark, blackish-brown in colour and viscous in texture. After being crushed in 20 per cent. glycerine it was examined under the oil-immersion (1·9 mm. obj., No. 15 oc.). The dissolved faecal deposit was reddish to brown in colour, and full of reddish granular particles of dissolved blood. Haemoglobin crystals and remains of white blood corpuscles indicated that although most of the blood is digested, some of it passes over undigested and the presence of haemoglobin in the faeces is important as indicating the possibility of the survival of micro-organisms in faeces not subjected to desiccation after ejection.

A freshly deposited dark brown faecal spot, deposited 23⅛ hours after feeding (human blood) was removed by my friend, Mr. H. T. Güssow, with sterilized water, and examined for bacterial organisms. Not a single organism could be found, but easily recognisable remains of blood which remained unstained by the carbol fuchsin were noticeable. Except for a light meal on beef gelatin stained with nigrosin, which almost proved fatal, this fly had only fed on my blood since its emergence from the pupa; nevertheless, the absence of bacteria from the faeces is somewhat surprising.

Frequency of feeding.

As a rule *Stomoxys* will not feed a second time within twenty-four hours of feeding, if the meal was a complete one. In one case a fly

which had taken a meal lasting $8\frac{1}{2}$ minutes, fed again when an opportunity was offered 18 hours later. They will usually feed readily, should the opprotunity occur, after a period of forty-eight hours since their former meal. How long, under natural conditions, they can exist without feeding has not been determined, but under experimental conditions a fly was very active 125 hours after feeding, the previous meal having taken 72 hours to digest. Provided they have access to moisture, which they will absorb readily, they will no doubt live many days without food.

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Stomoxys calcitrans feeding and almost fully gorged; enlarged about nine times.

On circulating excitations in heart muscles and their possible relation to tachycardia and fibrillation.

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Presented by PROF. T. G. BRODIE, F.R.S.C.

(May 27, 1914.)

§ 1 *The propagation and duration of the excited state in heart muscle.*

If a strip of heart muscle, living but not exhibiting spontaneous activity, is touched at one end with the point of a needle, an altered state is aroused at the point stimulated which is rapidly propagated over the strip. This altered state, the "excited state," is characterised essentially in two ways—by a difference of electrical potential between the part of the tissue in the excited state, and a part not excited and by the inability of the tissue to respond to a second stimulus (absolute refractory period). The onset of the excited state is normally followed very shortly by a mechanical movement, which continues as contraction until the excited state disappears and then gives place to relaxation.

The relation between the mechanical response and the excited state is such that the former can, under certain conditions such as the removal of calcium, be abolished while the latter remains. Contraction is not an essential part of the excited state.

The excited state is propagated in the ventricle of the frog or the tortoise at room temperature at the rate of about 10 cms. per second, while it persists at any one point a considerable time, e.g. 1″ or 2″. Thus if the strip is only 3 or 4 cms long, the excited state will still be present at the point stimulated when it has reached the other end of the strip, and for a time the whole strip will be in the excited state. In other words the wave of excitation is longer than the strip of tissue. But if now a second stimulus is applied so as to start a second wave in the tissue as soon as possible after the subsidence of the first wave

[1] Owing to the sudden death of the Author before this paper was printed, the proofs have been read by Dr. T. G. Brodie, who desires to be held responsible for the corrections.

at the point first stimulated, this second wave presents two important points of difference from the first wave. The second wave is propagated more slowly, and it lasts a shorter time at any point in the tissue.

Since the second wave lasts a shorter time than the first, a third wave can be started sooner after the beginning of the second wave than could the second after the beginning of the first. This third wave is again slower in its rate and shorter in its duration at any one point. By several repetitions it is possible thus to get a succession of waves each of which is actually shorter than the strip of tissue.

Thus by the time a wave has reached the far end of the strip it has left the end to which the stimulus was applied.

A series of similar waves can be kept going by a series of evenly spaced stimuli at this rapid frequency; but if a few members of the series of stimuli be cut out and then the series resumed, the responses will be of a different character and the heart muscle will respond only to every second stimulus. The slow propagation and short duration of the waves of excitation are characteristic of the tissue when it is thrown into activity with but very brief periods of rest.

Let us suppose we have the strip now being stimulated at such a rhythm that the waves of excitation are shorter than the strip. So far as we can make out, the conduction of the excited state is fairly expressed thus:—when one region of the muscle becomes excited and is in physiological connexion with a neighbouring region which is excitable but not excited, the excited state is induced in that neighbouring region, and so on.

Be it noted that our statement implies the assumption that the "excited state" the rate of travel and the duration of which we measure by the electrical disturbance and the refractory phase, is as it were a self-propagating affair. The only justification for such an assumption is that we can demonstrate no change antecedent to these signs of the excited state. The possibility that there is some antecedent change which is the thing really propagated and that the excited state is called forth at successive points in the muscle by the passage of a preliminary wave, must not be lost sight of.

An observer of the mechanical response in the muscle, seeing the wave of contraction start at the point stimulated, and course over the muscle at a rapid rate, might well imagine that conduction meant that when one region contracted it caused the neighbouring region to contract and so forth. But a study of other changes in the muscle shows very definitely that the mechanical contraction is a change called forth at each point in the muscle, by an antecedent change in the muscle. The wave of contraction reflects precisely enough the

rate of propagation of this change, but the contraction is in no way essential to the propagation. However, at present we have no sufficient reason to assume any wave *preceding* the excited state, and we may return to our discussion of the behaviour of the strip. Suppose it to be in a condition where a wave of excitation is shorter than the strip, and now suppose that the ends of the strip are united so as to form a ring. Under such circumstances, the wave having made one circuit of the ring would continue to propagate itself, finding the place where it started excitable when it reached it again.

We do not know at present how to bring the ends of a strip of muscle into physiological continuity, but we can easily obtain closed conducting rings by cutting them from a large piece of heart muscle

§ 2. *Circulating excitations.*

It was shown in 1908, by A. G. Mayer[1] that in a ring of excitable tissue cut from the bell of the large Medusa Cassiopeia it is possible to establish a local block and by stimulating on one side of it to set going a wave which travels in one direction only. Removing the block before the circuit was completed by the wave, the wave continues to circulate round the ring indefinitely.

In a former paper[2] I have explained the theoretical and experimental considerations which led me to seek the production of a similar phenomenon in heart muscle. I there gave a short account of experiments in which the circulating waves, or as I prefer to call them, circulating excitations, were set going.

(a) in rings including portions of auricle from the tortoise.

(b) in rings cut from the auricles of elasmobranch fishes.

Last autumn, through the kindness of Professor Yves Delage, I had the opportunity of making further experiments at the Station Biologique in Roscoff.

I will describe one typical experiment which illustrates several points.

Large Dog-fish (Acanthias). Killed by decapitation. Spinal cord pithed. Heart excited and placed in a dish with blood. Beats continue regularly, starting in sinus. Scratching the bulbus aortae produces the effect described by Gaskell with great ease. Beats start in bulbus at a faster rhythm and are transmitted backwards over ventricle and auricle for five or six beats, then the normal sequence is resumed.

After half-an-hour the heart is beating well. Cut away sinus: the auricle and ventricle stop. Cut off auricle, slit it up to form a ring,

[1]A. G. Mayer. Popular Science Monthly. Dec. 1908. p. 481.

[2]G. R. Mines. Journ. of Physiol. *46*. p. 349, 1913.

spread it out on a glass plate, pour on serum and cover up with a vaselined watch-glass. Preparation remains quiescent for quarter of an hour. Pricking with a needle point provokes a strong contraction. Wave runs round ring in each direction; the waves meet on the opposite side of the ring and die out. Repeated the stimulus at diminishing intervals and after several attempts started a wave in one direction and not in the other. The wave ran all the way round the ring and then continued to circulate going round about twice a second. After this had continued for two minutes extra stimuli were thrown in. After several attempts the wave was stopped. The preparation then remained at rest for ten minutes. The circulating excitation was again started in the same way as before. This time there was considerable difficulty in stopping the wave. A number of attempts caused slowing of the wave in its passage over part of the course, but failed to arrest it. Presently a single stimulus was so timed as to arrest the wave. The preparation then remained absolutely quiescent. There was no sign of 'automatic' rhythm throughout this experiment. After cutting through the ring in one place, the strip of tissue responded with a single contraction to each of a series of stimuli if suitably spaced. It was found impossible to get more than one response to a single stimulus.

I have repeated the experiment successfully on five preparations from dog-fish auricles. A large heart must be taken otherwise it is difficult to secure that the duration of the refractory state shall be shorter than the time taken by the wave to pass round the ring. The chief error to be guarded against is that of mistaking a series of automatic beats originating in one point in the ring and travelling round it in one direction only owing to a complete block close to the point of origin of the rhythm on one side of this point. The cleanest experiments are those, such as that quoted above, in which the auricle showed no tendency whatever to give spontaneous beats. Severance of the ring at that point will obviously prevent the possibility of circulating excitations but will not upset the course of a series of rhythmic spontaneous excitations unless by a rare chance the section should pass through the point actually initiating the spontaneous rhythm.

Ordinary graphic records either mechanical or electrical are of no value in attesting the occurrence of a true circulating excitation in rings of this kind, since the records show merely a rhythmic series of waves and do not discriminate between a spontaneous series of beats and a wave of excitation which continues to circulate because it always finds excitable tissue ahead of it. The only method of recording the phenonenon which I have found of any use is cinemato-

Fig. 1.

Fig. 2.

graphy. Fig. 1. is enlarged from one image taken from a cinematoraph film of an auricle ring exhibiting circulating excitation.

I have also succeeded in producing excitations in rings of mammalian ventricle. In many cases I have failed to get the requisite conditions, but in seven experiments on the ventricles of large dogs and in one cat's heart I have been able to demonstrate conclusively the production of true circulating excitations. In the best experiments the procedure was as follows:—

The heart was excised from the anaesthetised animal (usually at the conclusion of some other experiment) and placed on a glass table. The right side of the ventricular wall was then cut out. The act of cutting generally provoked fibrillation. In the sheet of muscle thus obtained a large hole was cut (see Fig. 2.) During this operation the fibrillation died out and the preparation became quiescent. The rest of the experiment followed a course similar to that described above for the auricle rings, except that the time during which the muscle remained excitable was very much shorter.

In a favourable experiment the vigorous circulating wave and its instantaneous arrest by section of the ring is a sight not easily forgotten.

Garrey[1] has recently described experiments made about the same time and independently of mine, on the production of circulating waves in rings cut from the base of the ventricles of large water turtles.

Garrey has succeeded in getting a number of waves following one another round the ring at the same time—just as Mayer did with the Medusa rings. This very interesting effect evidently depends on two factors, the large size of Garrey's ring, and the fact that when starting the wave the tissue was fibrillating and therefore ready to give the type of wave characteristic of the very active tissue —a short wave slowly propagated.

Garrey very justly emphasises the fact that for a circulating wave a uni-directional block is a necessary condition. In his experiments he was able to demonstrate uni-directional block repeatedly: "it appeared to be related to the irregular width of the blocking and consequently the differences in strengths of the inpulses passing a given point of block." Erlanger had previously noted uni-directional block in strips of auricle. In the frog's heart, when exhausted, I have occasionally observed uni-directional block between auricles and ventricle. In some cases the direction blocked was from ventricle to auricle; in other cases from auricle to ventricle. In the latter case it is very curious to see the auricular contractions not followed by

[1]Amer. Journ. Physiol. *33*. March 1914. p. 397.

any movement of the ventricle, yet the ventricle ready to respond to direct stimulation and to call forth an extra beat of the auricles.

The cause of uni-directional block may very likely be expressed thus in terms of Adrian's work. The region of blocks is a region of decrement, situated between two normal regions. If the decrement is uniform, then the system is symmetrical and the blocking should be equal in the two directions. But if the decrement is greater at one end of the "depressed" region than at the other, we have the possibility that transmission in one direction may be easier than in the other.

It is evident that the uni-directional block need not necessarily persist for more than a very short while in order to start a circulating excitation.

3. Tachycardia and circulating excitations.

It is a fact familiar to the physician and to the physiologist that a heart which has been beating regularly and in normal sequence may sometimes suddenly exhibit a new rhythm of a totally different character. While in some cases the new rhythm is related to the original rhythm in some simple ratio, and is explicable on the hypothesis of partial heart blocks between the region originating rhythm and the rest of the heart or between auricles and ventricles, there are other instances where there is no such relation to be made out between the normal and the abnormal rhythms.

Last year I showed that certain instances of tachycardia observed during experiments on cold-blooded hearts, where the excitations of the auricle and ventricle were proved to be mutually dependent, might best be explained as circulating excitations, the impulse passing from auricle to ventricle by one path and returning from ventricle to auricle by another path.[1]

I ventured then to suggest that some instances of paroxysmal tachycardia observed in man where auricles and ventricles beat with the same frequency might conceivably be explained along somewhat similar lines. I now repeat this suggestion in the light of the new histological demonstration by Stanley Kent[2] that the muscular connexion between auricles and ventricles in the human heart is multiple.

Stanley Kent shows that an extensive muscular connexion is to be found at the right-hand margin of the heart at the junction of the right auricle and right ventricle.

Supposing that for some reason an impulse from the auricle reached the main A-V bundle but failed to reach this "right lateral"

[1]Mines, loc. cit.

[2]Stanley Kent, Quart. Journ. Exper. Physiol. VII, p. 193. 1913.

connexion. It is possible then that the ventricle would excite the ventricular end of this right lateral connexion, not finding it refractory as normally it would at such a time. The wave spreading then to the auricle, might be expected to circulate around the path indicated. But if the recovery of the main A-V connexion or of the ventricle itself was not sufficiently rapid, the circulating wave could not continue and what would be observed would be a series of groups of this type
aur.-ventr.-aur. ——— aur.-ventr.-aur ——— aur.-ventr.-aur. etc.
a type of rhythm known to occur both under experimental conditions and in disease.

We know enough of the physiological properties of heart muscle and the arrangement of the fibres in the human heart to enable us to speak of a circulating excitation between auricles and ventricles as a theoretical possibility and to say that if it did occur, auricles and ventricles would beat at a much more rapid rate than normal and that the onset and the disappearance of the abnormal rhythm would be abrupt.

Fibrillation.

The suggestion that the abnormal character of the heart's activity in fibrillation depends essentially on abnormality of conduction was put forth by W. T. Porter in 1898. Porter's view has recently received very strong support from the experiments of Garrey,[1] to whose admirable paper I would refer the reader. Garrey points out that fibrillation is more easily aroused and is more persistent in large than in small pieces of heart muscle and he shows that it is most unlikely that the self-maintained activity in fibrillation is due to an exaggerated power of ectopic impulse formation. Garrey arrives independently at a closely similar conclusion to that which I expressed in a recent paper,[2] namely, that fibrillation is due to waves travelling in closed circuits in the syncytium.

Garrey observes that if the above conclusion is correct, it is not surprising to find the onset of fibrillation induced by such conditions as local differences of temperature or the application of certain drugs which may reach one region sooner than another. Professor Starling has mentioned to me that in the course of his numerous experiments on heart-lungs prepared from the dog, a detail of technique which he found of some importance was to avoid touching the surface of the heart with a cold instrument, since this was found very frequently to start fibrillation.

The most certain method of starting fibrillation is by the application of a faradic current directly to the heart. The rapid series of

[1] Garrey. Amer. Journ. Physiol. *33*. p. 397. March, 1914.

[2] Mines, loc. cit.

induction shocks has the same effect as a series of stimuli so spaced that one is thrown into the muscle just after the conclusion of the absolute refractory period associated with the response to the last stimulation. Thus the duration of the excited state of each response becomes shorter and the rate of propagation becomes slower until the characteristics essential for the circulating wave are attained. Once started the existence of fibrillation tends to maintain the conditions necessary for its appearance.

Yet under some conditions a stimulus of very brief duration may induce fibrillation. I propose to describe here some experiments showing how the relation of the time of application of such a brief stimulus to the cardiac cycle may be of great importance in determining whether or no the stimulus will initiate fibrillation.

The production of fibrillation in the cooled ventricles of the rabbit by the application of a properly timed stimulus.

In these experiments the hearts of rabbits were profused with Ringer's solution (NaCl 0·9%, KCl 0·042%, $CaCl_2$ 0·024%, $NaHCO_3$ 0·1%) by Langendorff's method, using the perfusion apparatus of Brodie. The perfusion was started at body temperature but was allowed to fall gradually to room temperature. A thread attached to the apex of the heart and to a lever enabled the ventricular movements to be recorded on a kymograph. As a rule, non-polarisable electrodes were placed in contact with an auricle and a ventricle and connected to an Einthoven galvanometer so that records of the electrical changes could be recorded when desired. A pair of platinum electrodes, separated by two or three millimetres, rested against one of the ventricles. These were connected with the secondary of an induction coil. Stimuli were delivered by single taps of a Morse key connected with the primary of the stimulating coil by means of a double relay so arranged that the moment of application of the stimulus was signalled by the simultaneous use of a sparking coil connected by a short air-gap with the insulated metal pointer and to the drum. It was found in a number of experiments that a single tap of the Morse key *if properly timed* would start fibrillation which would persist for a time which varied in different cases from a few seconds up to over three hours, then giving place suddenly to a normal sequence of beats. The fibrillation affected the ventricles only and was never transmitted back to the auricles.

The point of interest is that the stimulus employed would never cause fibrillation unless it was set in at a certain critical instant. Figures 3, 4, and 5 illustrate the phenomenon. In Fig. 3 the first stimulus applied falls within the refractory phase and does not in-

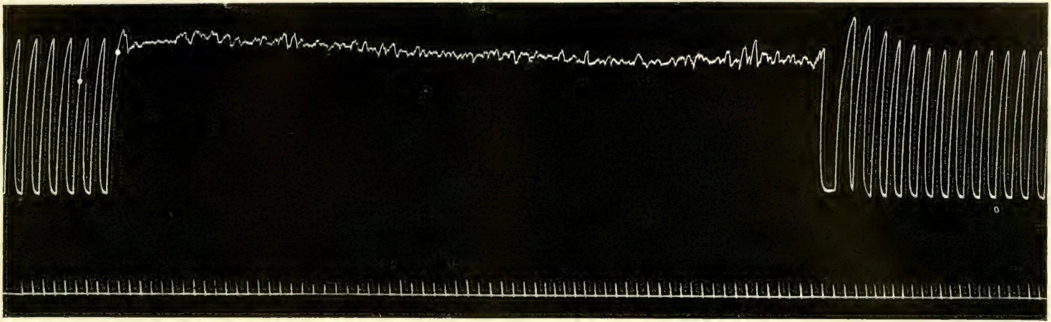

Fig. 3.

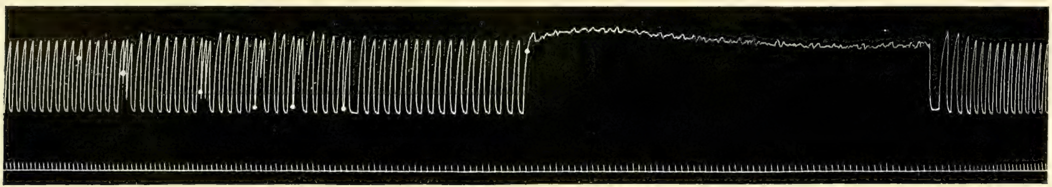

Fig. 4.

fluence the rhythm. The next stimulus, coming a little later in the cycle, set up fibrillation which persists for a certain length of time and then suddenly ceases. In Fig. 4 it is seen that stimuli coming later than the critical instant for the production of fibrillation merely induce an extra-systole, while a comparison of the position of the last stimulus shown with the first, indicates that the critical instant for the production of fibrillation is immediately after the close of the refractory phase. In figure 5 are given some examples of electrograms taken before and during fibrillation set up in the manner described. The appearances of the electrograms are compatible with the idea of a rapid periodically repeated change under the electrode on the ventricle.

In the production of fibrillation in the manner just described, the stimulus apparently arrives at some part of the ventricular muscle just at the end of the refractory phase and probably before the refractory phase has ended in some other regions of the muscle. If this is so, we have again a difference in condition of different regions of the muscle as a basis for the inauguration of the state of fibrillation. It seems possible that circulating excitations may play an important part in the maintenance of fibrillation, but it seems to me that there is another possibility which deserves careful testing. Suppose that A and B are two regions of heart muscle close together. If the region A, is thrown into the excited state, in the ordinary course of events the region B immediately after enters the excited state itself; this is the ordinary conduction process. Now suppose that at the time when excitation is set up in A, B is in the refractory state. It cannot then be excited by A. But the excited state set up in A will persist for a considerable time, and the refractory state will disappear from B before the excited state has ceased in A. The question is: Is it ever possible that under these circumstances A will excite B ?

Conceivably such a state of affairs may arise only under particular conditions of the heart muscle. If we can, we have in such residual excitations a basis for several varieties of anomalous cardiac activities of which fibrillation is one.

DESCRIPTION OF FIGURES.

Fig. 1.—Ring cut from auricle of Acanthias vulgaries, in which a circulating excitation was produced. From a cinematograph film. About three quarters natural size.

Fig. 2.—Ring cut from right ventricle of dog. A centimetre scale photograph beside the muscle. Circulating excitations were set going in this preparation.

Fig. 3.—Kymograph record of lever attached to ventricles of a rabbit's heart, profused with Ringer's solution by the coronary system. The bottom line marks time in seconds. The white spots on the heart tracing were produced by sparks from the pointer, employed to signal the moment of stimulation of the ventricle by induction shocks. The first stimulus applied fell within the refractory phase, the second stimulus, just outside the refractory phase, produced fibrillation. Temperature 24·7°C.

Fig. 4.—From same experiment as previous figure but one hour later. Temperature 22·5°C. Signals as before. Shows that stimuli too early or too late are ineffective in producing fibrillation. The last stimulus applied arrives at the critical instant.

Fig. 5.—Electrograms taken with Einthoven galvanometer from profused rabbit's heart. The abscissae represent fiftieths and tenths of a second. Temperature 26°C. Electrodes for galvanometer on rt. auricle and l. ventricle. (1) shows spontaneous beats, (2), (3), (4) shows stages of fibrillation induced by induction shock. The kymograph tracing at the bottom serves as a key. The electrograms were taken during the process of the kymograph record at the times indicated by the longer lines projecting from the time tracing, which represents seconds as before.

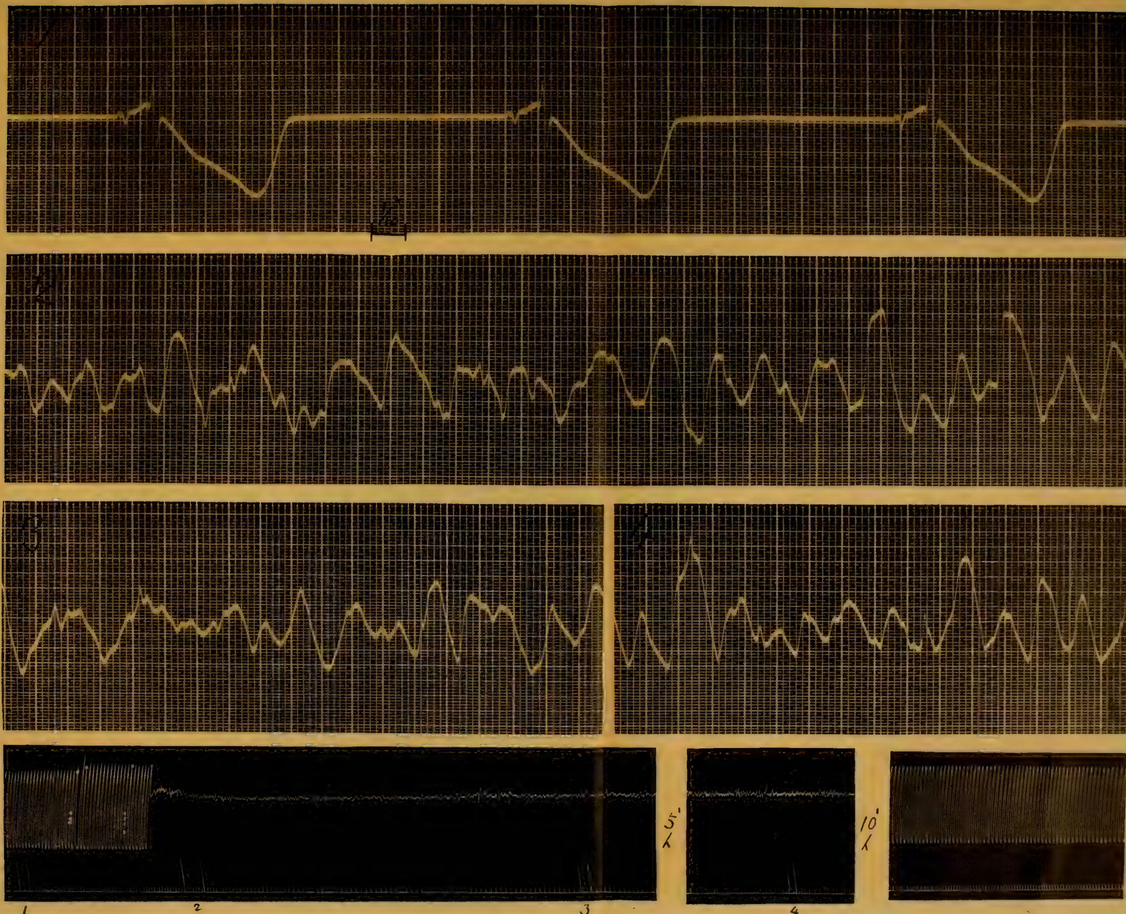

Fig. 5.

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Contributed by REV. PROF. C. J. S. BETHUNE, D.C.L.

(Read by title, May 27, 1914.)

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The Sawflies of the Province of Quebec. Fifth Ann. Report Quebec Soc. Protection of Plants, etc. pp. 27-31, 1913. (Gives a list of species and brief descriptions of some of the most injurious forms).

36. *Gahan, A. B.*
Identity of *Scotioneurus stenostigma*, Prov. Proc. Ent. Soc. Washington, vol. 15, pp. 38-40, April 1913. (A full description of Provancher's type specimen which is now placed in the genus *Aspilota* of the family *Alysiidae* as it does not belong to the *Aphidiinae*).

37. *Gahan, A. B.*
A new genus and one new species of Chalcidoidea. Can. Ent. vol. 45, pp. 178-182, June 1913. (The new genus, Coelopisthoidea, includes *Coelopisthia nematicida*, Pack., a parasite of the Large Larch Sawfly *Lygeonematus erichsonii*, Hartig).

38. *Gahan, A. B.*
New Hymenoptera from North America. Proc. U. S. Nat. Mus. vol. 46, No. 2035. pp. 431-443, one plate, Dec. 1913. (Includes a new species, *Coelinidea ferruginea*, family Alysiidae, represented in the Museum collections by four specimens labelled "273." Parasitic on *Meromyza americana*, James Fletcher, collected at Ottawa, July 21, 1899.")

39. *Gibson, Arthur.*
Insects of the year in the Ottawa District. 43rd Annual Report, Ent. Soc. Ont., pp. 11-17, 1913. (Describes the prevalence and work of many injurious insects affecting field and fruit crops, forest and shade trees, garden and greenhouse plants.)

40. *Gibson, Arthur.*
The Entomological Record for 1912. 43rd Annual Report Ent. Soc. Ont. pp. 113-140, 1913. (The twelfth annual publication of this record of captures of new and rare insects made by collectors throughout the Dominion in the Lepidoptera, Coleoptera, Diptera, Hymenoptera, Hemiptera, Archiptera, Neuroptera, Trichoptera, Odonata and Araneida; references are also given to the literature of the year).

41. *Gibson, Arthur.*
The Cotton Moth, *Alabama argillacea*, Hbn. Canadian Entomologist, Vol. XLV, p. 100; April, 1913, 1 fig. Note on a flight observed at London, Ont).

42. *Gibson, Arthur.*
Flea-beetles and their Control, Circular No. 2, Division of Entomology, Dom. Exp. Farms, pp. 1-11, 14 illustrations, issued June 1913. (This circular which was prepared chiefly for farmers and horticulturists, treats of thirteen species of destructive flea-beetles. Various methods of control are discussed.)

43. *Gibson, Arthur.*
The more Important Injurious Insects which attack vegetables in the Province of Quebec. Journal of Agriculture and Horticulture, March 1st and April 1st, 1913. (An account of the commoner forms which every year cause serious damage, such as cutworms, root maggots, etc; remedies are given).

44. *Gibson, Arthur.*
Some insects that attack the roots of vegetables. Fifth Annual Report of the Quebec Society for the Protection of Plants from Insects and Fungus diseases, pp. 41-42, Dec. 1913. Root Maggots, White Grubs, Wireworms and Carrot Rust-Fly, are discussed).

45. *Gibson, Arthur.*
Occurrence of the Cotton Moth in Ontario in 1912. Ottawa Naturalist, Vol. 27, Aug.-Sept. 1913, p. 71. (A record of important flights of this moth, *Alabama argillacea*, in Western Ontario).

46. *Gibson, Arthur.*
Controlling the Plum Curculio. Canadian Horticulturist, Vol. 36, No. 10, Oct. 1913, page 240. (Remedies briefly discussed).

47. *Gibson, Arthur.*
List of Lepidoptera of Toronto District. Natural History of the Toronto Region, Canadian Institute, 1913. (The list in this volume includes 619 species, chiefly Macro-lepidoptera.)

48. *Gibson, Arthur.*
The Preparatory Stages of *Apocheima rachelæ*, Hulst. Can. Ent., Vol. 45, pp. 401-05, plate and figures, Dec. 1913. (Egg, larval stages, pupa and female moth described; distribution in Canada noted).

49. *Hampson, Sir George F.*
Catalogue of the Lepidoptera Phalaenae in the British Museum, Vol. 12, Noctuidae, 626 pages, plates 192-221, 134 figures, 1913. (Deals with the subfamily Catocalinae and treats of 63 genera and 643 species, of which a large number are found in Canada).

50. *Hewitt, C. Gordon.*
Report of the Dominion Entomologist. Ann. Rept. Exptl. Farms. Dept. Agric. Canada, pp. 173-189, one plate, 1913. (The annual report of the work of the Dominion Entomological Service for the year 1912-13. Contains summarised accounts of: 1, the work of inspecting and fumigating imported nursery stock; 2, the field work against the Brown-tail Moth; 3, insects affecting field and fruit crops; 4, forest insects; insects affecting domestic animals and man, and garden and greenhouse; 5, apiculture and miscellaneous information).

51. *Hewitt, C. Gordon.*
The Spring Grain Aphis or "Green Bug." Can. Ent. Vol. 45, pp. 77-80, March 1913. (Describes and comments upon the investigations carried on by the Bureau of Entomology of the U. S. Department of Agriculture recorded in Bull. No. 110).

52. *Hewitt, C. Gordon.*
The Imperial Bureau of Entomology. Can. Ent. vol. 45, pp. 171-174, June 1913. Science, n.s. vol. 37, No. 957, pp. 659-660; Journal Econ. Ent. vol. 6, pp. 274-276, 1913. (An account of the formation, organization and objects of the Bureau and the publication of its journal "The Review of Applied Entomology").

53. *Hewitt, C. Gordon.*
The Insect Food of Fresh-water Fishes; its econonic importance in relation to fish culture and the conservation of Fresh-water Fish. Fourth Annual Report, Commission of Conservation, Ottawa, 12 pages, one plate, 1912.

54. *Hewitt, C. Gordon.*
Review of Entomology relating to Canada in 1912. 43rd Annual Report, Ent. Soc. Ont. pp. 34-37, 1913. (Refers especially to the submission of questions to the International Committee on Nomenclature and the formation of an Imperial Bureau of Entomology in connection with the London Colonial Office. An account is also given of the work of the Entomological Division at Ottawa).

55. *Hewitt, C. Gordon.*
Bibliography of Canadian Entomology for 1911. Trans. Royal Society of Canada. Third series, vol. 6, Section IV, pp. 115-127, 1913.

56. *Huard, V. A.*
La respiration chez l'insecte. Le Naturaliste Canadien, vol. 39, No. 11, pp. 172-176, Mai; No. 12, pp. 189-192, Juin; vol. 40, No. 3, pp. 40-47, Sept.; No. 4, pp. 59-64, Oct. 1913. (Continuation of a series of papers dealing with the structure, anatomy, etc., of insects).

57. *Huard, V. A.*
Insectes nuisibles dans la Province de Quebec; le "San José Scale." Le Naturaliste Canadien, vol. 40, No. 1, pp. 8-12, Juillet 1913. (An outline of the history of the scale and a record of its first appearance in the Province).

58. *Huard, V. A.*
Rapport de l'Entomologiste du Ministere de L'Agriculture pour l'année 1912-1913. Le Naturaliste Canadien, vol. 40, No. 6, pp. 93-96, Decembre 1913. (The writer's first report as Provincial Entomologist for Quebec is begun in this number).

59. *Hudson, H. F.*
The Chinch Bug in Ontario. 43rd Annual Report Ent. Soc. Ont., 1913, pp. 46-50. (An account of the infestation of an area comprising about five square miles in Western Ontario by this injurious insect, which has hitherto been little known in the Province. Methods of control are also given).

60. *Johnson, C. W.*
Species of the genus *Gaurax* of the Eastern United States. Psyche, vol. 20, pp. 34-35, February 1913. (Includes one new species of these Dipterous flies, *G. pseudostigma*, taken at Toronto).

61. *Kirkaldy, G. W.*
Generic tables for the Cimicid subfamilies Phyllocephalinae, Phloeinae and Dinidorinae. Can. Ent., vol. 45, pp. 81-84, March 1913. (A paper on the Hemiptera-Heteroptera by the late author and edited by Mr. J. R. De la Torre Bueno).

62. *Lochhead, William.*
The teaching of Entomology in our Agricultural Colleges. 43rd Annual Report, Ent. Soc. Ont. pp. 38-40, 1913. (Outlines a plan of instruction for a four years' course).

63. *Lochhead, William.*
Injurious insects of Quebec in 1912. 43rd Annual Report Ent. Soc. Ont. pp. 85-87, 1913. (A list of those observed in most abundance).

64. *Lochhead, William.*
Parasitic Insects in the control of injurious forms. Fifth Ann. Report Quebec, Soc. Protection of Plants, etc., pp. 12-23, 1913. (Gives an account of various attempts to utilize parasites in the control of noxious insects, especially in the warfare against the Gypsy and Browntail moths).

65. *Lochhead, William.*
Concerning Cutworms, Wireworms and White Grubs. Fifth Ann. Report Quebec Soc. Protection of Plants, etc., pp. 85-94, 1913. (Short descriptions and figures of many of the commonest species and methods of control).

66. *Lochhead, William.*
A synopsis of Economic Entomology. Macdonald College, P.Q., 1913, 113 pages. (Contains keys to injurious insects and a classification and description of common forms, with instructions for control, etc.).

67. *Lyne, W. H.*
Two injurious insects of economic importance attacking peach, apricot and plum trees. Proc. B.C. Ent. Soc. No. 3, n.s. 1913, pp. 34-35. (Describes the Peach-twig borer, *Anarsia lineatella*, and the Peach-root borer, *Sanninoidea exitiosa*, and gives methods of control).

68. *MacGillivray, A. D.*
The immature stages of the Tenthredinidae. Can. Ent., vol. 45, pp. 367-371, November 1913. (Describes the general life-history from egg to pupa of Sawflies).

69. *Malloch, J. R.*
Notes on the synonymy of some genera and species in the Chloropidae (Diptera). Can. Ent. vol. 45, pp. 175-178, June 1913. (A revision of the nomenclature of the American genera of the family, to which the name Oscinidae has also been given).

70. *Malloch, J. R.*
Descriptions of new species of American flies of the family Borboridae. Proc. U. S. Nat. Mus. No. 1958, vol. 44, pp. 361-372, February 1913. (One species *Borborus arcticus*, is described from specimens taken in Labrador).

71. *Malloch, J. R.*
Two new species of Diptera in the United States National Museum collection. Proc. U. S. Nat. Mus. No. 1962, Vol. 44, pp. 461-463, February 1913. (One species, *Fannia tibialis*, family Anthomyidae is described from specimens taken at Kaslo, B.C.).

72. *Malloch, J. R.*
Notes on some American Diptera of the genus Fannia, with descriptions of new species. Proc. U. S. Nat. Mus. No. 1972, Vol. 44, pp. 621-631, one plate, April 1913. (One new species, *F. aethiops*, described and figured, is recorded from Ainsworth, B. C.)

73. *Malloch, J. R.*
Three new species of Anthomyidae (Diptera) in the United States National Museum collection. Proc. U. S. Nat. Mus. No. 2004, Vol. 45, pp. 603-607, June 1913. (Of the new genus *Paralimnophora* the species *brunnesquama* was taken at Ottawa, Montreal and St. John, N.B.; the third species *Anthomyia bidentata* is from Kaslo, B.C.).

74. *Malloch, J. R.*
A revision of the species in *Agromyza* Fallen, and *Cerodontha* Rondani, (Diptera). Annals Ent. Soc. America, vol. 6, no. 3, pp. 269-340, four plates, Sept. 1913. (Two new species are described from Ontario and one from British Columbia; descriptions are also given of other species taken in Canada).

75. *Malloch, J. R.*
A synopsis of the genera of Agromyzidae, with descriptions of new genera and species. Proc. U. S. Nat. Mus. vol. 46, No. 2018, pp. 127-154, three plates, Dec. 1913. (Describes and figures *Paramyia nitens* Loew, and *Meoneura lactipennis*, Fallen, taken at Kaslo, B.C.).

76. *Malloch, J. R.*
The genera of the flies in the subfamily Botanobiinae (Diptera) with hind tibial spur. Proc. U.S. Nat. Mus. Vol. 46, No. 2024, pp. 239-266, two plates, Dec. 1913. (A new species, *Hippelates nitidifrons*, was taken at Montreal and *H. flavipes*, var. *pusio*, Loew, at Ottawa).

77. *Matheson, R.*
The present status of the San José Scale in Nova Scotia; a Bulletin of information. Bull. 3, Nova Scotia Dept. Agric. Truro, pp. 16, 1913. (Relates the discovery of the scale in the Province, the methods taken for its extermination and a general account of the insect).

78. *Matheson, R.*
The Injurious Insect, Pest and Plant Disease Act, 1911, and regulations issued thereunder. Bull. 4, Nova Scotia Dept. Agric. Truro, 1913, pp. 14.

79. *Matheson, R.*
The Brown-tail and Gypsy Moths, Bull. 5, Nova Scotia Dept. Agric. Truro, 1913, pp. 36, three plates. (Life-histories of both insects and an account of the spread of the former in the Province and the control work adopted).

80. *Matheson, R.*
Aquatic Insects. 43rd Annual Report Ent. Soc. Ont. pp. 92-96, 1913. (States that all insects were originally terrestrial animals and describes the modifications which have taken place in order to fit them for an aquatic environment; draws attention to their use as food for fishes and the importance of their culture for this purpose).

81. *Melander, A. L.*
A synopsis of the Sapromyzidae, Psyche, vol. 20, pp. 57-82, April, 1913. (Provides tables of genera and species of this Dipterous family. Several species taken in Canada are included).

82. *Melander, A. L.*
Some Acalyptrate Muscidae. Psyche, Vol. 20, pp. 166-169, October 1913. (Includes a new species, *Trixoscelis fumipennis*, from Aweme, Man.).

83. *Melander, A. L.*
A synopsis of the Dipterous groups *Agromyzinae*, *Milichiinae*, *Ochthiphilinae* and *Geomyzinae*. Journal New York Ent. Soc. Vol. 21, No. 3, pp. 219-273, September; ibid, No. 4, pp. 283-300, one plate, December 1913. (A number of species found in Canada are included).

84. *Middleton, M. S.*
Cutworms and their control. Proc. B. C. Ent. Soc. No. 3, n.s. 1913, pp. 36-37. (Recommends the poisoned bait and methods of cultivation).

85. *Morris, F. J. A.*
Chrysomelians of Ontario.- Can. Ent. Vol. 45, pp. 384-392, November 1913. (Field observations in the neighborhood of Port Hope, Ont., on many species of these beetles).

86. *Palmer, L. L.*
Some problems in Aphis control. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 31-34.

87. *Petch, C. E.*
Insects of Quebec for the year 1912. 43rd Annual Report Ent. Soc. Ont., pp. 72-75, 1913. (Gives a list of the chief insects attacking apple trees and a life history of the Apple Curculio, *Anthonomus quadrigibbus*).

88. *Pierce, W. Dwight.*
Miscellaneous contributions to the knowledge of the Weevils of the families Attelabidae and Brachyrhinidae. Proc. U. S. Nat. Mus. Vol. 45, No. 1988, pp. 365-426. (Contains many tables of species and includes references to several forms taken in Canada).

89. *Richardson, C. H.*
A new Braconid of the genus Microdus from Canada. Can. Ent., vol. 45, pp. 211-212, July 1913. (The species was reared from the Bud-moth, *Tmetocera ocellana*, and is named *Microdus ocellanae*).

90. *Rohwer, S. A.*
Descriptions in the Woodwasp superfamily Oryssoidea, with descriptions of new species. Proc. U. S. Nat. Mus. Vol. 43, No. 1925, pp. 141-158. (Includes descriptions of *Oryssus Sayi*, West, and *O. terminalis*, Newm, taken at Ottawa. Maps are given showing world-wide distribution of genera).

91. *Rohwer, S. A.*
A synopsis and descriptions of the Nearctic species of Sawflies of the genus Xyela, with descriptions of other new species of Sawflies. Proc. U. S. Nat. Mus. Vol. 45, No. 1981, pp. 265-281, May 1913. (Includes one new species, *X. dissimilis*, from Banff, Alberta).

92. *Ross, W. A.*
Recent work on the Apple Maggot in Ontario. 43rd Annual Report Ent. Soc. Ont. pp. 67-71, 1913. (An account of investigations into the life-history of the insect, methods of control both natural and artificial, and the area of infestation).

93. *Ruhman, M. H.*
The importance of Economic Entomology as a subject of education. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 27-28.

94. *Sanders, G. E.*
The San José Scale in Nova Scotia, 43rd Annual Report Ent. Soc. Ont., pp. 61-65, 1913. (An account of the discovery of this dangerous scale in the Province and the measures adopted for its eradication).

95. *Saunders, William.*
An invasion of Cotton Moths. 43rd Annual Report Ent. Soc. Ont. 1913, pp. 84-85, 1913. (The appearance at London, Ont., of swarms of *Alabama argillacea* in October, 1912).

96. *Shelford, V. E.*
The life-history of a Bee-fly, *Spogostylum anale*, Say, parasite of the larva of a Tiger-beetle, *Cicindela scutellaris*, Say, var. *Lecontei*, Hald. Annals Ent. Soc. America, vol. 6, No. 2, pp. 213-225, June 1913. (The geographic distribution of both parasite and host includes British Columbia).

97. *Sladen, F. W. L.*
Bumble Bees and their ways. 43rd Annual Report Ent. Soc. Ont., pp. 50-56, 1913. (A full account of the life and habits of these social insects and the important part they fulfil in the domain of Nature; the author also describes the methods employed for their observation).

98. *Sladen, F. W. L.*
Queen-Rearing in England, with Notes on a scent-producing organ in the worker-bee and how pollen is collected by the honey-bee and bumble-bee. 2nd ed., pp. vi and 86, col. plate; London, Madgwick Houlston & Co., Ltd. (A copiously illustrated description of the technique of rearing queen bees, and of the author's investigations into the physiology and structure of specialized organs in the worker-bee).

99. *Sladen, F. W. L.*
The role played by bees in the Fertilization of Flowers. 5th Ann. Rep. Quebec Soc. for Protection of Plants, p. 39-40, 1913. Outlines the inter-relation of bees and flowers and shows the value of bees for pollinating clover and fruit blossoms).

100. *Sladen, F. W. L.*
Bee-breeding. Ann. Rep. Beekeepers' Assoc. of the Prov. of Ont. for 1912. p. 59-62. (Discusses the prospects of improving the honey-bee by scientific methods of breeding).

101. *Strickland, E. H.*
Some parasites of Simulium larvae and their possible economic value. Can. Ent. Vol. 45, pp. 405-413, plate, December 1913. (A full and valuable account of the parasitism of the larvae of Black-flies).

102. *Swaine, J. M.*
Notes on some forest insects of 1912. 43rd Annual Report Ent. Soc. Ont. pp. 87-91, 1913. (Mentions a large number of injurious species, and draws especial attention to the desirability of transferring parasites from a locality where they are abundant to one where the outbreak is not so severe in order to control the ravages of the Larch Sawfly).

103. *Swaine, J. M.*
The economic importance of Canadian Ipidae. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 41-43. (Gives an account of a number of species of bark-borers and Ambrosia beetles and the injuries they inflict).

104. *Swaine, J. M.*
A Forest Insect survey in British Columbia. Canadian Journal of Forestry, November, 1913. (A brief statement of the chief Forest Insect Outbreaks in British Columbia).

105. *Swaine, J. M.*
Insect Problems in Canadian Forests. Report of the Canadian Forestry Association, 1913.

106. *Swaine, J. M.*
Tent Caterpillars; Entomological Circular No. 1, Division of Entomology, Dominion Experimental Farms; pp. 1-14; 8 illustrations, 1913. (An account of the American and Forest Tent Caterpillars, with control measures for orchards and private grounds).

107. *Swaine, J. M.*
Some Insect Enemies of Shade-trees. Fifth Report of the Quebec Society for the Protection of Plants, 1913; pp. 43-58; 12 illustrations. (Descriptions of a number of seriously injurious species).

108. *Swett, L. W.*
Geometrid Notes—new varieties. Can. Ent., vol. 45, pp. 75-76, March 1913. (Describes *Ania limbaria* var. *Chagnoni*, n. var. from St. John's Co., Quebec).

109. *Taylor, L. E.*
Economic Ornithology. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 37-41. (Refers to various insect and seed-eating birds, and draws special attention to the danger incurred by introducing birds from other countries).

110. *Tothill, J. D.*
Tachinidae and some Canadian hosts. Can. Ent. Vol. 45 pp. 69-75, March 1913. (Thirty species of the parasitic flies are given and forty-six hosts).

111. *Tothill, J. D.*
Progress of the introduction of the insect enemies of the Brown-tail Moth, *Euproctis chrysorrhea*, Linn, into New Brunswick and some biological notes on the host. 43rd Annual Report Ent. Soc. Ont., pp. 57-61, 1913. (The insects referred to are the Tachinid parasite, *Compsilura concinnata*, and the predaceous Ground-beattle, *Calosoma sycophanta*).

112. *Tothill, J. D.*
A study in variation in the North American Greenbottle flies of the genus Lucilia, with systematic notes on the species involved. Annals Ent. Soc. America, Vol. 6, No. 2, pp. 241-256, June 1913.

113. *Townsend, C. H. T.*
Inquiry into the relationships and taxonomy of the Muscoid flies. Can. Ent. vol. 45, pp. 37-57, February 1913. (A careful study of this superfamily of the Diptera based upon dissections of the female reproductive organs, the eggs and maggots, as well as upon the external characters).

114. *Treherne, R. G.*
Notes on injurious insects in British Columbia in 1912. 43rd Annual Report Ent. Soc. Ont., pp. 106-111, 1913. (Mentions the principal insects attacking appletrees, small fruits and vegetables, and describes the life-history and habits of the Strawberry Root-weevil, *Otiorhynchus ovatus*).

115. *Treherne, R. C.*
Methods of taking insect records in the field. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 21-24. (Describes a method for determining the percentage of infestation and amount of injury).

116. *Van Duzee, M. C.*
A revision of the North American species of the Dipterous genus Neurigona (Dolichopodidae). Annals Ent. Soc. America, vol. 6, No. 1, pp. 22-64, two plates, March 1913. (Includes descriptions of five new species and several previously known which have been taken in Canada).

117. *Venables, E. P.*
Notes on some Coleoptera of the Okanagan Valley, B. C., Can. Ent., vol. 45, pp. 267-268, August 1913. (A list of about forty species of Cicindelidae and Carabidae).

118. *Walker, E. M.*
Insects and their allies. The Natural History of the Toronto Region, Chapter 22, pp. 295-403, 1913. (Lists of species of all the orders recorded from the vicinity of Toronto).

119. *Walker, E. M.*
New Nymphs of Canadian Odonata. Can. Ent., vol. 45, pp. 161-172, two. plates, June 1913. (Descriptions are given of thirteen species with figures of various structures).

120. *Walker, E. M.*
Mutual adaption of the sexes in *Argia moesta putrida*. Can. Ent. vol. 45, pp. 277-279, one plate, September 1913. (A careful description with figures of the genitalia of this species of Odonata).

121. *Walker, E. M.*
The Faunal Zones of Canada. Annual Address of the President. 43rd Annual Report, Ent. Soc. Ont. 1912, pp. 26-33. (Explains the map recently published in the Canadian Entomologist and describes the faunal characteristics of the zones in Canada).

122. *Webster, F. M.*
An early reference to the occurrence of the Army-worm in Pennsylvania, New York and Canada. Can. Ent. vol. 45, p. 16, January 1913. (Refers to the observations made by John Bartram, an English traveller, in 1743).

123. *Webster, F. M.*
The disastrous occurrence of *Vanessa californica* in California and Oregon during the years 1911-1912. Can. Ent. vol. 45, pp. 117-120, April 1913. (This remarkable profusion of the butterfly extended to British Columbia).

124. *Webster, F. M.*
Applied Entomology for the farmer, Can. Ent. vol. 45, pp. 393-397, November 1913. (Contrasts the assistance rendered the grain-grower and stock-raiser in the control of insect pests five and twenty years ago with that of the present time).

125. *Weiss, H. B.*
Notes on the Death-feint of Calandra oryzae, Linn. Can. Ent., Vol. 45, pp. 135-137, May 1913. (Gives a record of the brief duration of the "death feint" in the case of the Rice weevil, which is a common and serious pest in flour mills and granaries.)

126. *Weiss, H. B.*
Odour preferences of Insects. Can. Ent. Vol. 45, pp. 302-304, September 1913. (Classifies odours into nine varieties and mentions their attractive powers for different insects).

127. *Wickham, H. F.*
New North American *Elateridae* and *Scarabaeidae*. Psyche, vol. 20, pp. 27-31, February 1913. (Includes two new species from Vernon, B. C.—*Limonius Venablesi* and *Aphodius Columbiensis*).

128. *Wilson, H. F.*
Combination sprays and recent insecticide investigations. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 9-16. (Describes the results of a series of experiments with combinations of various insecticides).

129. *Winn, A. F.*
Newfoundland Lepidoptera. Can. Ent. Vol. 45, p. 24, January 1913. (Gives a list of thirteen species collected at St. Anthony's during the summer of 1910).

130. *Winslow, R. M.*
The economic side of pest-control. Proc. B. C. Ent. Soc. No. 3, n.s., 1913, pp. 17-20. (A discussion of the comparative cost of the application of insecticides in fruit production.)

131. *Wolley Dod, F. H.*
Further notes on Alberta Lepidoptera, with the description of a new species. Can. Ent., vol. 45, pp. 29-34, February 1913. (Continuation of a series of notes on Noctuidae. The new species is *Mamestra mutata*).

132. *Wolley Dod, F. H.*
Further notes on Alberta Lepidoptera. Can. Ent. vol. 45, pp. 61-68, March 1913; pp. 93-98, April; pp. 129-134 May; pp. 186-192, June; pp. 236-244, July; pp. 296-302, September. (These papers deal with the Noctuids and a few of the Geometridae).

133. *Wolley Dod, F. H.*
Notes on some North American Noctuidae, Entomological News, Vol. 24, pp. 249-257, June; ibid, pp. 356-366, October 1913. (Includes a number of Canadian species).

134. *Yothers, M. A.*
Eugonia californica, Boisdv., in the Pacific Northwest. Can. Ent., vol. 45, pp. 421-422, December 1913. (Records the occurrence in British Columbia and Idaho of enormous numbers of the caterpillars of this butterfly in 1912).

Addendum.

135. *Koenike, F.*
A revision of my "Nordamerikanische Hydrachniden." Translated by Prof. E. M. Walker, University of Toronto. Trans. Canadian Institute, vol. ix, 1911, pp. 281-296, two plates. (Eight species are fully described and figured from Canadian material).

136. *Walker, E. M.*
The North American Dragonflies of the genus Aeshna. University of Toronto Studies, Biological series, No. 11, viii, 213 pages, 28 plates (six coloured). Published by the Librarian, University of Toronto Library, 1912. (An admirable monograph, and the most complete and valuable work on a group of Canadian insects that has as yet appeared. The illustrations by the author are of remarkable excellence).

The Physics of the Cambrian Formation in Eastern Canada, and the peculiarities of its Faunas.

By G. F. MATTHEW, D.Sc., LL.D.

(Read May 27, 1914.)

Certain puzzling variations in the Cambrian faunas of eastern Canada have been observed by the writer in the course of his study of these faunas, that are worthy of more than a passing notice. These are not easily explained as changes due to the vertical relations of the faunas, but seems rather to be the result of special environment, leading to the introduction of new types by migration or otherwise. It seems, therefore, desirable to say something more than has hitherto been attempted on the physics of the several Cambrian basins in eastern Canada and their relation to faunal changes.

Of the several basins of Cambrian rocks in eastern Canada, one may take as the standard, those of southern New Brunswick, as having the fullest representation of Cambrian forms of life; and as containing also several Ordovician faunas. It is only by the contained animal remains that we know that certain faunas of the latter system are present there, near the top of the terrane, but over large areas both the upper Cambrian and the Ordovician faunas have been obscured by metamorphism and not infrequently entirely removed by denudation.

The observer will note that there were three terranes or series of deposits in this region very diverse in their aspect and probably of different chronological value; these consecutive terranes have been distinguished as the Coldbrookian and Etcheminian terranes and the St. John Group. We propose to consider the faunas of the first and second as giving the initial conditions prevalent at the opening of the Palæozoic Age in this region, and to refer briefly to some interesting faunal groupings in the St. John group.

COLDBROOKIAN TERRANE.

The St. John basin is that which gives us most fully the physical history of this region of the earth's surface in the earliest Palæozoic time. On both sides of this basin, and simultaneously or nearly so, there bursts forth eruptions of basic and acid lavas, which were piled up in the mountain masses that can be seen to run parallel to each

other on opposite sides of the basin for twenty miles or more, or until they are lost on the one hand beneath post Cambrian strata and on the other beneath Devono-Carboniferous strata. Dr. L. W. Bailey, who spent a season in the study of these eruptions, considered that those of the southern range of hills had originally been piled up to a height of one or two miles. There is an intimate relation between them and the overlying red sediments on both sides of the basin. Nowhere have we found a conglomerate at the base of this terrane but usually amygdaloids or breccias, spread over a weathered land surface.

In New Brunswick no fauna has been found at the bottom of this terrane, for it has not there any marine accumulations; but in Cape Breton beds of shale have been found intercalated with the effusive rocks at the base of the Palæozoic column in that island, from which a few species of Brachiopod and Ostracods have been taken. The known species are the following:—

Acrothyra signata m. prima.	Brachiopods.
Acrotreta papillata m. prima.	
Leptobolus torrentis.	
Lingulella cf longovalis.	
Lingulepis pumila.	
Escasona (? ?) ingens.	Ostracods.
Indiana ovalis m. prima.	

This limited list of seven species presents a series of forms which is so much like that of the fauna in the next terrane above that it cannot be regarded as a wide departure from known Etcheminian types, all of the genera except one of the Ostracods being such as are found in the terrane above. Nevertheless they are of interest to the naturalist as showing the most ancient types of animals recognized in the Palæozoic rocks of the Maritime provinces of Canada.

ETCHEMINIAN TERRANE.

On a previous page when speaking of the red sediments that rest upon the volcanic rocks of the St. John basin, no allusion was made to other basins of Cambrian rocks to the north of the St. John basin. There are two of these. That of the Kennebecasis which is next the St. John basin, does not show the great bulk of measures found in the St. John basin, perhaps partly because important areas are now submerged beneath the waters of Kennebecasis Bay and its branches. In this Cambrian basin both the volcanic rocks and the overlying red sediments are entirely wanting, and the lowest beds exposed are the basal members of the St. John group itself, which a little above

its base yields typical Cambrian fossils. As the effusive and the red rocks are entirely wanting in this basin and there are conglomerates at the base of the red rocks in the St. John basin, it would seem that the connection between these red rocks and the St. John Group is not so close as in Cape Breton.

A third basin of Cambrian rocks farther to the northwest, however, repeats the conditions in the St. John basin so far as relates to the basal effusives and red rocks, though the measures of the several divisions of the St. John group itself are thin, as in the valley of the Kennebecasis.

To Cape Breton we need to turn to get a good knowledge of the faunas which mark that part of Palæozoic history preceding the deposition of the St. John group. In that island we find effusive rocks everywhere at the base of the Cambrian series. At more than one place these rocks may be seen to rest on schist or granitic rock, and this is softened and decomposed at the base as though it had been subjected to long continued sub-aerial weathering. Yet the older rocks must have been near the sea level, for while in most districts they are underlain by a solid mass of effusive rocks, on Indian brook these rocks are comparatively thin, and on Dugald brook, a branch of that stream, they contain the beds of gray shales that contains the few species of Coldbrookian fossils listed on a preceding page. On this brook also is to be found the fullest representation of the Etcheminian faunas.

The rocks along this stream have yielded quite a variety of the earliest types of Palæozoic Brachiopods and Ostracods; and although Trilobites appear to be absent from all but the highest assise, there is a sufficiently great variety of forms in the two former classes to distinguish two sub-faunas in this Etchemmician terrane.

Not only faunally, but also physically a distinction may be noticed between the upper and the lower part of the Etcheminian terrane in Cape Breton, for while both consist largely of volcanic effusives, the upper or later portion is composed of finer sediments and is of a purer grey color; this difference of color and texture is noticeable both in the valley of the Mira river and in the basins bordering the East bay of the Bras d'Or lake.

ST. JOHN GROUP.

DIVISION 1 (ACADIAN).

In passing from the Etcheminian to the St. John terrane there must have been an important change in the physical conditions of

the earth's surface in this region; volcanic effusions entirely ceased, and purely abrasive products formed the bulk of the sediments; in eastern Cape Breton the basal beds are conglomerate, but in New Brunswick they are firmly cemented gray sandstones, the upper beds of which gradually pass into sandy gray shales containing the fauna discussed below.

PROTOLENIAN ZONE.

The fauna of this group has not been recognized in Cape Breton, but its place is between the Etcheminian and the beds holding Paradoxides. The Brachiopoda show among the species with round valves distinct genera in different basins in which the fauna of this group has been found. Thus in the St. John basin we have *Tremotobolus insignis*, in that of the Kennebecasis valley *Protosiphon Kempanum* and in that of the "Long reach" of the St. John river *Botsfordia pulchra*, each so far as known peculiar to its own basin and the whole not more than a dozen miles apart. Of course it may be said that these shells probably belong to different assises of the zone, but the gray sandy shales in which they are found are apparently essentially similar. The entire independence of these types may be due to the rapid changes through which the fauna was passing.

The genus Acrothele serves to link this fauna with the Etcheminian below and the Paradoxides above, and helps to show the interdependence of the three faunas.

The typical genus of this fauna, if it were not unquestionably beneath Paradoxides stratigraphically, might be thought to belong to the Upper Paradoxides fauna, on account of its resemblance to the genus Anomocare, Angelin; it is probably an ancestral related type, without the wide anterior border to the head shield which marks the typical species of Anomocare of the Swedish Paradoxides beds. It is probable that the pygidium is more freely developed in Protolenus than in Anomocare, and the long eyelobe of the former genus is in keeping with its early appearance in time.

Perhaps the most striking forms of the Protolenus fauna are the Ostracoda which are of large size, and appear scattered sparsely over the surface of the layers; thus they do not seem to have had the habit of swarming, so notable in the later animals of this class—but led a comparatively independent life. Although most of the Ostracoda of the Protolenus fauna are smooth the genus Hipponicharion was notably tuberculated or ridged, thus resembling Beyrichia, which, however, is not found further down than the upper part of the Paradoxides zone.

The basal beds of the St. John group may be compared with those at the base of the Cambrian terrane in eastern Quebec. As on the north side of the Gulf of St. Lawrence so on the shores of the Bay of Fundy, the lowest strata are barren sandstones. In the former region the sandstones give place to limestones which contain an Olenellus fauna, but in the latter the beds which follow the sandstones are glauconiferous shales holding the Protolenus fauna.

These gray and greenish gray sandstones and shales were spread over the St. John basin and are found in each of the other two basins of Cambrian rocks near to it.

By some examples cited above we have shown the diversity of the Brachiopods in this fauna, but the unity of the fauna is shown by the trilobites, which apparently were better fitted for migration from one area to another. They were Nekton, while the Brachiopods were Benthos.

Though not found in all parts of the Kennebecasis basin, the Protolenus sandstones and shales, where they come to the surface, are uniform in their appearance with the more widely and more evenly distributed strata of the same age in the St. John Basin.

One character which links together the Protolenus beds of the St. John group and the Olenellus limestone of southern Labrador, is that both have numbers of Foraminifera associated with the other fossils; those of Labrador so far as I know have not been described.

The Protolenus beds of the St. John basin abound in nodules of phosphate of lime. These nodules are also found in the Cambrian sandstones of Sweden, where they are supposed to have been formed in a shallow sea of clear ocean water, in the vicinity of the coastline.

PARADOXIDES BEDS.

On entering this part of the Cambrian system we meet not only a different class of sediments but a much greater abundance and variety of organic remains. In this group though it is not a very bulky one, we have evidence of three or four distinct substages, each containing its special group of organisms, and each characterized by some differences in the aspect of the mud in which the organic remains were buried. They all indicate deposition of a fine clayey sediment on a sheltered area of the sea-bottom, probably a comparatively shallow bay, protected from strong marine currents.

LAMELLATUS SUBZONE.

The older portion of the Paradoxides beds shows a full proportion of sub-faunas at St. John and thus enable one to compare it closely with the Lower Paradoxides beds of Europe.

The oldest portion has been designated the Paradoxides lamellatus substage or zone, as being characterized by the *P. lamallatus* of Hartt and its accompanying fauna. The rock here is a very fine grained gray shale and is in marked contrast with the coarse sandy shales of the Protolenus zone which underlie it. Its texture indicates slow deposition in placid waters. Here we are able to make use of trilobites as markers of special zones of life. There are two characters that mark these early forms of trilobites which are less pronounced in those of the substage above; one is the wrinkled or ridged surface of the test in most of the species, the other is the presence of prickles or spines on the surface of others.

The genus *Liostracus* appears in this early substage. The writer has limited this name of Angelin to such Ptychoparoid species as had smooth tests and are devoid of genal spines; this is the case with *L. ouangondianus*, Hartt, which is our representative of the *L. aculeatus* of Angelin, the type of the genus. But a more striking member of this genus is *L. tener* of Hartt, notable for the prominent curved ridges on the fixed cheeks and correspondingly elevated eyelobes. For many years we had thought that this form was peculiar to America, but a representatives of it was found some years ago in the Cambrian strata of the Montaigne Noir in the south of France by Mons. Jean Miquel, who has done important work in elaborating the Cambrian faunas of the south of France.

Of the Conocryphinæ, typical genera of the Lower Paradoxides beds* two forms are found in this early subzone, viz, *Conocoryphe Walcotti* allied to *C. Baileyi*, Hartt, of the subzone above, but with a smoother and thinner test; and *Ctenocephalus Matthewi*, Hartt var. *perhispidus*. The former shows the thin flexible test marking many of the species of this subzone, the latter the very hispid surface of other species.

Passing to the Brachiopods and Gasteropods we find a variety of small thin shelled species, none of which play an important role in the fauna, and there are some Phyllopods and Ostracods.

ETEMINICUS SUBZONE.

But it is in the next member of the St. John Group that we are in the presence of a full and varied fauna of the Paradoxides beds. In this subzone the slate is of a coarse texture and the fossils in some places have been rolled together, forming calcareous nodules, abounding with the disjointed skeletons of numerous animals, chiefly trilobites,

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*Hence Angelin, the Swedish palæontologist, called this zone the Region of the Conocoryphees.

but with many simpler and smaller organisms intermingled. In this subzone calcareous organisms are more abundant than in the shales above and below.

Of the calcareous forms two species are more abundant than others, *Protorthis Billingsi* and *Eocystites primævus*. These no doubt assisted in adding to the large amount of lime which the shales of this subzone contain.

This subzone is especially the home of Paradoxides for it has furnished at least four species of the genus. By far the most common species is *P. Eteminicus*, the American representative of *P. rugulosus* of Bohemia; next in order of abundance is the *P. Mic-mac* of Hartt, noted for its thin and easily wrinkled and distorted tests; next the rather rare little species *P. Acadicus*, the only species at this horizon with a granulated test. Another scarce species is the giant *P. regina* which may be compared in this respect with the large *P. Davidis*, found by Dr. Henry Hicks in Wales; the pleurae of the Canadian species may be recognized by their great size. The granulated test of *P. Acadians* seem out of place in these soft shales, tests of Cambrian trilobites with such surface seeming to be related to harder conditions of environment and coarser sediments, as witness *P. cf. Forchhammeri* of Cape Breton and *Olenellus Thompsoni* of Southern Labrador.

As showing the variation in the composition of faunas due to habitat, we call attention to that of Young's Point. The first collections from this place being imperfect led to the fauna being compared with those of the Ordovician system; but an examination of the stratigraphy of the district resulted in placing the fauna at the base rather than the summit of the Cambrian system; further collections made by Dr. Percy Raymond showed that they were to be regarded as of the Paradoxides zone. The age of this fauna is more fully discussed in a later part of this article.

ABENACUS SUBZONE.

The upper subzone of the Paradoxides beds in the St. John basin is characterized by the presence of the species *P. Abenacus*, which is the American representative of *P. Tessini* of Sweden; it is also notable for the abundance of the *Agnosti* as well as of the Pychoparinæ, *Ptychoparia* and *Solenopleura* being common genera at this horizon. The shale of this subzone is quite fine in texture and somewhat darker than that of the beds below; it probably contains more diffused organic matter.

The limited exposures of Cambrian rocks in the Kennebecasis valley give only imperfect means of comparison of the different mem-

bers of the Cambrian in this valley and those of the St. John Basin, but in cases where the comparison is possible we are struck by the remarkable discordance in the faunas that characterize the two basins at points not more than three miles apart. The age of the fauna at Hastings Cove is fixed by the dark shales in the upper part of the measures seen at this cove which contain the *Abenacus* subfauna. To the south of this cove rises a high hill of pre-Cambrian limestones, against which the oldest of the Cambrian beds rest. These contact beds contain numerous pebbles of the limestone and more of the associated granitic rocks of the hill, and point to the derivation of much of the material of the Cambrian beds from the adjoining Pre-Cambrian rocks; they tell us that these granitic rocks were extruded before the Cambrian age.

When we come to investigate the fossils of these contact beds of the Cambrian, which are below dark shales holding *P. Abenacus*, we are surprised at the heterogeneous collection of species which they contain. The zoological standing of this fauna is discussed in the Bulletin of the Natural History Society of New Brunswick, Vol. IV, p. 40; but in brief it may be said that it contains genera which elsewhere are referred to the Olenellus, the lower Paradoxides and the upper Paradoxides zones; on the whole the genera of the fauna indicates that it should be placed at the top of the Lower Paradoxides zone; yet we see that this fauna underlies fine shales that contain *P. Abenacus* (cf. *Tessini*) *C.I.d.*

The difference of this Hasting's Cove fauna from the typical fauna of the P. Abenacus subzone seems most easily explicable on the basis of a difference of environment; in the one locality a steep and rocky coast-line, in the other a muddy sheltered bay. The contact of the Hastings Cove strata with the pre-Cambrian rocks of the adjoining hillside is due to transgression, as there are older parts of the St. John group in other parts of the Kennebecasis Valley.

In the St. John basin the P. Abenacus shales are found to be of uniform texture and composition at both ends of that basin and to carry a similar fauna, which, however, is best shown at the eastern end of the basin. Here there is quite a varied group of species, the most abundant and the most typical being various forms of trilobites, Pychoparinæ which appear in the lower subzones, especially that of P. Eteminicus, here become abundant and varied, while the Concoryphinæ on the contrary are represented only by examples of *Ct. Matthewi.* Agnosti and Microdisci abound, and in the former genus most of the subgeneric forms are present, while the latter is reduced to the one form represented by the *M. pulchellus* of Hartt.

The fine grained dark gray mud of which this subzone is composed tells of smooth waters and show deposition in a sheltered bay, and the fauna is one that would have flourished in such a place.

DIVISION 2 (JOHANNIAN).

These conditions were changed as time went on by the removal of the barrier which has kept out the ocean surf and seams of sand begin to alternate with the dark mud until in time the fauna of the Paradoxides beds was banished and the typical conditions of Division 2 of the Cambrian succession was established, viz., alternations of coarse gray slates and gray flags and sandstones. Ripple or wave marks on these sandstones show that the open sea was to the south of the St. John basin. In this portion of the Cambrian System in eastern Canada, the remains of trilobites are exceedingly rare, hence the means of close identification are wanting.* There are remains of corneous Brachiopods, but these do not afford a basis for determination of the age of the several assises. Moreover, there is a great variation in the bulk of the strata of this division in the several basins where the Cambrian strata are found; it is only when we encounter finer deposits, shales, coming in at the base of Division 3, that the trilobites and calcareous Brachiopods reappear, and afford means of comparison with the Cambrian strata of other lands.

Although the strata of this division of the Cambrian system are to all appearance arenaceous or argillaceous there must have been considerable calcareous matter intermingled as numerous calcareous as well as siliceous veins are found in the sandstones.

DIVISION 3 (BRETONIAN).

The oldest strata of this division recognizable by fossils are found in the ledges which connect Navy island in the harbor of St. John with the main land. At this point and along the shore in this upper part of the harbor of St. John, one can trace the contact between the flags and slates of Division 2, and the finer soft black shales of Division 3. This division has a thickness of about 700 feet, the whole width of the harbor at this point, but most of these soft rocks are concealed beneath its waters. Navy island which alone rises to the surface contains characteristic fossils of three faunas, viz., Parabolina, Peltura and Dictyonema. On the opposite (northern) side of the harbor still higher shales are seen, which have yielded characteristic Arenig

*In Cape Breton the remains of a Paradoxides have been found about two thirds from the base of the flags and sandstones of this division.

graptolites. The Arenig of Wales has been built up with fine mud deposits, like those of the St. John, but there is also much effusive materials of volcanic origin, but in the Canadian rocks of equivalent age there are no volcanic rocks whatever. The graptolite beds are not the highest beds of the St. John group, for there are overlying shales with thin sandstone seams that contain a higher fauna of the Ordovician, but still in the lower part of that System.

The enormous denudation to which this region has been subjected since early Palæozoic times, has left remains of this highest division of the St. John group only in the deep synclines into which its strata have been thrown, and in many cases and over large areas these strata have been so much altered that the abundant remains of marine animals which it once contained, have to a great extent been obliterated; we only know from the scattered patches with fossils which it still holds, that it was accumulated very slowly, and marks the passage of a long period of time, roughly represented by the Upper Cambrian and the Lower Ordovician.

The black color which characterizes much of the fine shales of this division is to be attributed to the large amount of organic matter set free by the decomposition of the great number of Hydrozoan organisms which flourished in the protected waters of these Cambrian basins.

Except in the St. John basin this upper part of the St. John group has been much attenuated or failed of deposition as it has not been recognized in the others. However, it recurs in Cape Breton where the shales with Dictyonema have been found and also the overlying Tremadoc fauna. The strata, however, had not been so saturated with bitumen as the rocks of corresponding age in the St. John basin.

CONCLUSIONS.

From what has been said in the preceding pages the following conclusions may be drawn as to the physical conditions that prevailed in the southern part of New Brunswick during Cambrian and early Ordovician times.

The Cambrian Age was preceded or ushered in by wide-spread volcanic eruptions on a partly or wholly emerged land.

Complementary to the building up of volcanic ridges came the sinking of adjacent parts of the earth's crust, producing sea-basins in which the Etcheminian and St. John strata accumulated. The first beds of the St. John group were gray sandstones now strongly cemented by interstitial si.ica. These were followed by glauconiferous sandstones and sandy shales (Protolenus beds); then pure gray shales

followed by darker gray shales (Paradoxides beds). These form *Division 1* of the St. John group. By increasing sandstone seams and coarser shales or slates, all of a gray color, this part becomes the massive strata of *Division 2* (Paradoxides—Olenus).

At the top these flags fine away and become by alternation of finer slate and the disappearance of the flags, the fine shales of *Division 3*, much of which is of quite a dark colour, owing to the abundant remains of Hydroid animals (*Graptolites* &c).

CAPE BRETON CAMBRIAN.

A quite similar succession is found in Cape Breton, where, however, the dark gray shales of the Paradoxides beds are not in evidence, but the change is from modified volcanic effusions to coarse slates with sandstones, followed by fine grained pale gray shales, and these by a great body of flags and sandstones that fully represent in physical characters the strata of Division 2 of the St. John group. These are well displayed along the shores of the Barachois harbor and the line of the Intercolonial Railway.

At the head of the above named harbor and up the valley of McLeod brook, the finer rocks of Division 3 come in and are recognized in the Dictyonema shales and similar fine strata containing a fauna equivalent to the Tremadoc fauna of Wales. The almost completely parallel physical history notable in the Cambro-Ordovician basins of southern New Brunswick and eastern Nova Scotia, though those basins are separated by hundreds of miles of strata of different age, is sometimes remarkable and testifies to the uniformity of physsical changes over large areas in Cambrian time.

NEWFOUNDLAND CAMBRIAN.

Passing eastward to Newfoundland a somewhat similar series of events may be traced by changes in the composition and succession of the sediments. The Cambrian rocks there are in most cases based on what the late Sir A. Murray called the "Intermediate" series, and while showing three faunas in a series of beds equivalent to the division of the St. John Group does not have above them as large a body of sandstones as are found in Division 2 at St. John. At Conception Bay in Newfoundland much of this division is under water, but at Trinity Bay, farther north, the passage to the upper division is more clearly seen and there is less diversity in the character of the sediments than at St. John, N.B. As at St. John and in Cape Breton, so here also in Newfoundland, the uppermost measures of the ter-

rane, in Conception Bay at least, are found to belong to the Ordovician system, for trilobites of this age have been found at Bell Isle in the iron bearing beds that are present in that island.

REVISION OF THE ETCHEMINIAN FAUNA OF CAPE BRETON.

After the differentiation of the Protolanus fauna from the Paradoxides fauna at the base of the St. John Group in the older Palæozoic rocks of eastern Canada, there still remained a fauna of a few species in the red sediments covering the volcanic effusives beneath the St. John group. Owing to there being a complete change in the aspect of the sediments in passing from these red beds to the gray beds of the St. John group, the former were thought to be of a different series from the St. John sediments.

In some cases these red rocks were seen to be divided from the volcanics by a breccia of volcanic fragments, but in others there were rounded quartz pebbles at the contact; everywhere, however, there seemed to be a close association between the volcanic effusives and the overlying red beds. Furthermore, in the basin of Cambrian rocks next north-west of the St. John basin, these Cambrian rocks had neither the volcanic terrane nor the red beds as a foundation, but rested directly upon very old pre-Cambrian rocks. It was therefore thought that there must be a difference of faunas between the St. John group and these red beds which were called the Basal Cambrian or Etcheminian, and their limited fauna was given the latter name. The fossils found in these beds are all marine organisms. At Hanford brook, about twenty-five miles east of St. John, they contain an Obolus and a Hyolithes beside other organisms, poorly preserved and of obscure generic types.

In a visit made to Newfoundland (1898) the writer found that there was a considerable fauna at this horizon in the Palæozoic rocks of that island. This was found at Conception Bay in the south-east part of Newfoundland and was distinct both from the fauna of the Protolenus zone and the higher parts of the Cambrian system.

Afterwards, being sent by the Geological Survey Department of Canada to investigate the Cambrian rocks of Cape Breton island in Nova Scotia, he noticed that the group of marine forms found in the calcareous sandstones of Young's point near George R. which from the genera reported as occurring there had been thought to resemble those of the Ordovician system, were really at the base of a great thickness of Cambrian rocks, and therefore could not be Ordovician. The

fossils were in arenaceous beds not far above certain volcanic effusives that physically hold the same relation to the Cambrian of this island that the resembling rocks do to those of the St. John group in New Brunswick and were thought to be of equivalent age and so were correlated with the Etcheminian. Since the writer's visit to Young's Point, Prof. Percy Raymond has visited this spot, and found that the fossil which the present writer, from imperfect material described as a "paradoxidoid trilobite" is really of the genus Paradoxides, of which Prof. Raymond found the middle piece of the head shield. He has kindly loaned me this head for examination; it proves to be a mould of the part mentioned and so does not show the outer surface. The discovery of this trilobite head in connection with the observations made on the material previously collected by the writer renders it highly probable that the species represented by these fragments is a species of Paradoxides of the Lower Paradoxides beds. If one could be sure that the head had not been distorted it might be referred to the species *P. Mic-mac*, Hartt of the *P. Eteminicus* subzone; in New Brunswick, however, the latter species is of more common occurrence in beds having the texture of those in which this fauna is entombed.

The occurrence of a true Paradoxides in this bed at once raises the fauna to a higher plane than the Etcheminian terrane, and renders necessary a revision of the report on the Cambrian rocks of Cape Breton in so far as relates to the assemblage of species in the sandstone at Young's Point.

Since these fossils are to be referred to the Lower Paradoxides beds the following changes should be made in the report referred to on the "Cambrian rocks of Cape Breton."

Page Line
17, 25, for " the upper division " read a part of
17, 26, " " Etcheminian " read St. John terrane.
17, 29, " " " " " "
17, 37, " " the base of the upper," read, of the St. John terrane
18, 10, " " middle of Etcheminian," read lower part of St. John terrane.
18, 13, 22, 26 for "Etcheminian" read, Paradoxides beds.

Transfer the lower half of page 18, page 19, and the first three paragraphs of page 20 to the St. John terrane, Acadian division, at page 59.

In the section of the report on Palæontology at page 69 erase "Holocephalus," "Paradoxidoid trilobites" "Hyolithes" and "Billingsella."

70, 28, for "Etcheminian or basal," read lower
" 30, after "to," insert, Clitambonites or,
" 31, for "basal," read lower
79, transfer the two last paragraphs to page 180 (at end of second paragraph)
85, HYOLITHES, and to the end of the page, transfer to page 183 at line 18.
84, transfer first and third paragraphs to page 183 and omit second paragraph.
110, and table on page 111, transfer to page 189, at end of third paragraph.

Page Line

112, line 1 for "five," read four, and for "two" read one.

112 1 for "five" read, four, and for "two" read one.

" 8, for "E.2 (*a* ?)", read CI*c*.

116 to page 122, transfer to page 199 (at foot)

123 for "Etcheminian rocks" read Paradoxides beds.

132 transfer this page to page 199.

148 to 151, as far as line 23, "obscured," transfer to page 213 at line 17.

149 for "E2*a*," read CI*c*.

174 HOLASAPHUS, page 175 and page 176 to line 3, transfer to page 232 line 17.

176 line 4, to line 23 transfer to page 223, line 10.

176 line 3 for "(E2a ?)" read (CI*c*).

179, from the table on this page, remove Lingulelle Selwyni, L. Roberti, Billingsella retroflexa, Holasaphus centropyge and Paradoxidoid trilobite.

The transfer of the fossils of Young Point to the Paradoxides zone, removes from the Etcheminian fauna several of the more advanced types of the Cambrian life zones that were thought to characterize it. Although one trilobite remains, only the middle piece of the head shield has been found and a free-cheek, &c.; we have referred this head shield to *Solenopleura*, on account of its general form but it is not a characteristic form of that genus, differing from it in the long eyelobe and broad marginal fold. For this cause and on account of its rarity it does not make a good horizon marker in the Cape Breton Cambrian, and so we are thrown back upon the Brachiopods for the selection of a type that may be regarded as characteristic.

The shells of this class are all Atremata or Neotremata.

The two subfaunas of the Etcheminian of Cape Breton are distinguished by subgenera of *Obolus* which is among the common bivalves of this terrane. The older *Eoobolus* has the central group of muscles far advanced in the valve, and there is a small scar, centrally placed in the middle of this group of muscles, not found in Obolus proper. In the more recent subgenus *Palæobolus* the central muscles are also far advanced, but the vascular trunks are approximated, and not spread apart as in Eoobolus. However, these markings on the inner surfaces of the valves are not always discernable, and in such case the differences from the Ordovician Oboli are not fully apparent.

Perhaps the most characteristic among the Brachiopods of this terrane is the little *Acrothyra*. This is a shell with a perforate beak to the ventral valve, but differs from *Acrotreta* with which it is associated in the advanced position of the central muscles, which have produced a long narrow callus extending half of the length of the valve. Acrothyra, though it appears in the earliest Etcheminian strata of Cape Breton island, does not reach its most characteristic form until the latter part of Etcheminian time, when the beak and callus attain the unusually elongated form of the typical species.

About the time of the appearance of the typical form of Acrothyra the first examples of the well-known genus *Acrothele* are met with in the Cape Breton Cambrian. But while its presence in the Etcheminian measures of Cape Breton marks the upper subfauna, this genus continues to be found also in the faunas of the Paradoxides beds both in this country and in Europe.

The genus *Acrotreta* also appears first in the Upper Etcheminian in Cape Breton, but is not confined to this group for it is a characteristic fossil of the Paradoxides zone and so its presence does not define the age of a set of beds with the same exactness as the little Acrothyra. We seem, therefore, to be thrown back upon this latter genus as the most distinctive from of the Cape Breton Etcheminian terrane.

Since Holasaphus, occurring in association with the Paradoxides, can no longer be regarded as an Etcheminian genus, it becomes necessary to remove it from an association with that terrane; hence it should be removed from a page in my paper on "Geological Cycles in the Maritime Provinces of Canada" where it is used as a typical form of the Etchiminian terrane; therefore erase the name at page 113 of that article.*

GENERAL REMARKS ON THE FAUNAS.

It is of interest to note that in placing the Young Point fauna in the Paradoxides zone several types which recall Ordovician genera are found to have had an earlier origin than the Ordovician age.

Billingsella. The resemblance to Clitambonites or *B. retroflexa* is such that it was once thought that the beds in which it occurs may have been Ordovician.

Holasaphus, occurring with it, has a compact head shield and has a spine on the front of this shield like Magalaspis of the Ordovician of northern Europe. The four other forms of Young Point resemble more those of the middle Cambrian, and yet the presence of a Paradoxides in company with them shows that we are dealing with one of the older Cambrian faunas.

An interesting point brought out by the study of the Cambrian faunas of Cape Breton island, is that the genus Beyrichia in America appeared in the Paradoxides beds; not, however, in the lower, but in the upper Paradoxides beds.

I think that Raphistoma, whose relatives are common in Ordovician strata, was not found in Cambrian measures until it was noted as occurring at Kelly's island, where it is found in sandstones of the age of Division 2 of the St. John group.

*Geol. Cycl. Marit. Prov. Can.—Trans. Ry. Soc. Can. (1908) Sec. IV, p. 133.

The basal Palæozioc terranes of Cape Breton are those which have yielded a profusion of early and primitive forms of the Brachiopoda and Ostracoda. These two classes of marine animals have left remains even in the few seams of shale that are intercalated with the oldest masses of volcanic ashes and scoria that were thrown out along the margin of the Cambrian sea in the region of Cape Breton and when we consider the diversity of the genera in these deposits, it is clear that we are dealing with a marine fauna already of considerable complexity.*

But the fauna these beds contain is so closely linked with that of the stratified rocks that overlie these volcanics, that the two are evidently parts of a consecutive series of measures of nearly the same geological age.

These two groups of marine animals show in some measure the types present in Cape Breton in this natal time of the Palæozoic faunas, so far as they can be recognized by their hard parts, preserved in the fine mud in which they were entombed. The remains so far observed belong to two classes of the animal kingdom, Crustacea and Brachiopoda. Of the former only one order, the Ostracoda, is represented and the species are of comparatively large size (*Escasona* ? and *Indiana*).

But there is a more varied representation of the Brachiopoda, in two of its divisions, that with sliding valves (*Lingulella*, *Lingulepis*, and *Leptobolus*) and that with a perforate beak to the ventral valve (*Acrothyra* and *Acrotreta*. All these were of genera which shewed a fuller development in the succeeding (Etcheminian) fauna.

But though so imperfectly represented in the Coldbrook terrane, these scanty remains show that the early Palæozoic species were present in the neighboring seas, awaiting an opportunity to develop their genera at those near-by shores, when the physical conditions should have made it possible.

We have found no trace of trilobites in the stratified marine beds of the Coldbrook terrane, but a species has been recognized in the uppermost assize of the overlying Etcheminian, in a primitive type referred to the genus *Solenopleura*.†

Neither in the Coldbrook terrane nor in the lower half of the Etcheminian, have we found any examples of the genus *Acrothele*,

*Geol. Surv. of Canada. Report on the Cambrian rocks of Cape Breton, 1903. Coldbrook terrane pp. 12, 71, 73.

†Referred to this genus on account of the general form of the headshield, but the eyelobe is too long and the marginal fold too wide and too heavy to accord with the type of this genus.

which becomes common in the upper Etcheminian, and extends on upwards through the lower Paradoxides beds. Was it a migrant from some other Palæozoic shore, or did it originate at this time?

The little *Leptobolus* which appeared in the Coldbrook terrane, also becomes plentiful and varied in the upper Etcheminian fauna; it was one of those type better fitted to quieter conditions of deposition than prevailed when the lower Etcheminian beds were deposited.

The Beaver Fluke, Amphistomum Subtriquetrum, Rudolphi.

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Presented by Dr. A. WILLEY, F.R.S.C.

(Read May 26, 1914.)

The first careful study of the anatomical and histological features of *Amphistomum subtriquetrum* is in the Inaugural Dissertation of Dr. Richard Otto. (1) As far as I can ascertain no mention has been made of the occurrence of a Trematode parasite in the American beaver (*Castor Canadensis*) prior to a notice by Dr. Willey (2) in 1912. The specimens here described were taken by him from various beavers trapped in the spring of 1912 and of 1913 in the Provinces of Quebec and Ontario. The worms were killed in sublimate and preserved in alcohol. Sections were studied which were made in three directions, transverse, sagittal and horizontal. These were for the most part stained with Haematoxylin and Orange G; but staining with Haemalum and Eosin was also tried. The latter combination brought out the layer of subcuticular cells and other remarkable elements such as certain large cells of the parenchyma and of the suckers particularly well. The xylol-paraffin method was found to be the most successful for embedding and sectioning.

Rudolphi (3) is the first author to record the Trematode parasite from the European beaver (*Castor fiber*) which he named *Amphistoma subtriquetrum* in 1814. In 1817 Bojanus (4) reported the same Trematode from the beaver and called it *Distoma amphistomoides*. In 1819 Rudolphi (5) described the parasite in his Entozoorum Synopsis. He diagnosed it as an "Amphistoma with slightly flattened body increasing in circumference towards the posterior end; with round pores, a small anterior and a large posterior; Habitat, cæcum and colon of *Castor fiber*." Further in the same work (p. 360) he writes: "The worm is whitish, two or three times longer than its diameter, the anterior pore is terminal, the posterior, situated a quarter of the body length from the caudal extremity, is very deep and wide with the margin of the opening turned sharply in; the back is convex even slightly keeled in specimens that have been long preserved, the abdomen is flattened, hence the name *subtriquetrum*. In his description Rudolphi confirms the internal features noted by Bojanus under the name

Distoma amphistomoides as follows; "Alimentary canal opening from the anterior pore, a common median genital opening, the posterior pore a muscular sac." Rudolphi saw no trace of nerves.

Bojanus (6) a few years later returned to the worm, adopting Rudolphi's name *Amph. subtriquetrum.* He now described for it both longtitudinal and diagonal muscles; a bifurcated intestine with blindly ending pouches (intestinal rami); and a nervous system, consisting of two anteriorly placed ganglia, joined by a supra-œsophageal commissure and giving off lateral nerve cords. He mentioned also the presence of two testes, formed of radiating masses of tubes, and of a coiled oviduct.

Amph. subtriquetrum is mentioned by *Laurer* (7) as having a layer of diagonal muscles such as he first described for *Amph. conicum.* Dujardin (8) included it in his classification and gave the name as *Amphistomum subtriquetrum*, which is the accepted form now. He gives some figures as to the size of the worm: length 6·75—15·75 mm.; anterior diameter about 2·25 mm., posterior diameter from 4·5—6·75 mm. Diesing (9) also gives a brief description, summing up the observations of earlier workers.

External Features.

The worms I have studied are covered with a smooth cuticle of greyish white colour in the preserved condition. In the fresh condition the body is pinkish, soft and mobile. The body is well rounded dorsally and flattened on the ventral surface. The diameter at its anterior end averages 2 mm. which increases to 4·5 mm., measured across the posterior sucker; the average length is 8 mm., this would of course be greater in the living specimen. The anterior or oral sucker is small and subterminal. The posterior is a very conspicuous circular cavity on the ventral surface, about one third of the body length from its hind end. The genital and execretory openings are distinctly visible in the whole specimen. The genital pore lies in the mid-ventral line a short distance behind the anterior sucker (Figs. 1, 2 and 7). The execretory pore is in the mid-dorsal line directly over the centre of the posterior sucker (Figs. 1, 2 and 8).

Digestive System.

The mouth is a transverse cleft which opens directly from the shallow pit of the anterior sucker into the wide pharynx. It is bounded by two contiguous bundles of sphincter muscles. This characteristic double sphincter is best seen in longtitudinal section (Fig 4). The

pharynx is without true diverticula but there are, at about the middle of its extent, two lateral pouchings of the cavity into the muscular wall. These are quite extensive, irregularly shaped sacs, completely surrounded by the pharyngeal muscles, each communicating with the gut by a short narrow canal (Figs 1 and 6). At its posterior end the pharynx narrows down to a short œsophagus which bends dorsalwards and divides to form the two arms of the intestine. These are simple and unbranched; they run the length of the body as parallel straight tubes which end blindly behind the ventral sucker. The digestive tubes are filled with a mass of food stuff in which bits of wood fibre are to be seen, showing that the worm is at least partly nourished by the food of the host.

Reproductive System.

(1) *Male genital organs.* The testes are two large much lobed sacs, lying one in front of the other in the middle ventral region of the body. The anterior testis belongs to the right side although it extends across the middle line; the posterior one is that of the left side. The posterior lobes of the anterior (right) testis overlap the anterior lobes of the other. A single *vas deferens* arises as a narrow tube from one side of each testis, runs forward with gradually increasing diameter, and unites with the other in an elongated sac, the *vesicula seminalis.* After bending sharply back on itself this leads into the *ductus ejaculatorius*, the terminal part of the sperm duct, which lies coiled in a strongly developed muscular cirrus sac (Fig. 3). The presence of the latter is exceptional in the genus *Amphistomum* (10). Before leaving the cirrus sac to enter the common genital sinus leading to the genital pore the *ductus ejaculatorius* is surrounded by cells of glandular nature, the so-called "Prostate glands."

(2) *Female genital organs* (Fig. 1). The ovary or germarium lies in the middle of the body, a little to the left side, just in front of the posterior sucker. The ripe ova pass backwards by a short narrow oviduct which arises from the posterior dorsal region of the ovary. Near its origin the oviduct gives off a backwardly directed branch longer than itself, known as *Laurer's Canal.* This is a slender median tube opening to the exterior on the dorsal surface about 0·75 mm. in front of the execretory pore. No *receptaculum seminis* is present. There are two yolk glands, each composed of numerous follicles closely packed together, which extend on either side from behind the sucker forward about half the length of the body. The bulk of them is below the intestinal arms and they spread out close to the lateral body walls. The two vitelline ducts, a straight tube from each vitellarium, unite

in the middle line in a small yolk reservoir which opens into the oviduct a short distance beyond the junction of the latter with Laurer's canal. Where it joins the vitelline reservoir the oviduct bends forward and at this point is called the *ootype*, being surrounded by a mass of unicellular glands, constituting together the shell gland. As it emerges from the shell gland the ootype is very narrow and the muscular walls are strongly developed. It is probable as suggested by Otto (11), that the eggs assume their typical ovoid shape as they move one by one through this narrow passage while the shell substance is still soft. The uterus widens out rapidly from the ootype and forms several loops above the sucker, then runs forward as an irregularly coiled canal dorsal to the testes. Just behind the *vesicula seminalis* the uterus turns to the ventral side and continues to the genital sinus below the cirrus sac. The average size of the mature egg in its shell is 0·15 mm. by 0·092 mm. The shell is smooth without projections of any kind. Numbers of spermatozoa were noted throughout the uterus and as far back as the junction of Laurer's canal. There is no internal communication between the male and female systems of the worm, probably fertilization is effected by the sperm of another animal.

Excretory System.

The excretory pore (Figs. 1, 2 & 4) leads by a short canal into a wide excretory bladder with thick, spongy, muscular walls. At its anterior end the bladder gives off two large vessels which extend forward on the right and left sides above the arms of the intestine. I was not able to follow the course of the excretory vessels satisfactorily beyond noting that they appeared only in the dorsal region in the posterior half of the body, while in the anterior half I found coiled tubes of equal size in the ventral region. According to Otto's description the dorsal trunks give off medial vessels which unite on the ventral side between the *vesicula seminalis* and the anterior testis.

Nervous System.

Two large anterior ganglia are joined by a commissure above the gut where the pharynx passes into the oesophagus. From the ganglia nerve fibres run forward to the oral end, and on each side a conspicuous bundle of fibres goes backward close to the ventral body wall as far as the posterior sucker.

The only point in which my observations differ from the published description of the *Amph. subtriquetrum* from the European beaver is

in the position of the excretory pore. Otto figures the bladder as extended into a thin tube which opens at the posterior end of the body. However, he does not mention the exact position of the pore in the text, and it is altogether likely that he observed it directly over the sucker, which Braun (12) gives as the position throughout the genus, and the appearance in the diagram is due to the difficulty of showing in a flat drawing things which lie in different planes. Therefore I consider that the fluke of the Canadian beaver (*Castor Canadensis*) and that of the European beaver (*Castor fiber*) are one and the same species, namely *Amphistomum subtriquetrum*.

It is very interesting in view of the fact that the hosts differ specifically to find the parasites identical in the Canadian and European beavers, and to find them occupying the same regions in the intestinal tract of the host. Last autumn I noted an analogous case when examining some specimens of *Gammarus* (apparently *G. limnaeus* S. I. Smith) from ponds on the Island of Montreal. The amphipod itself differed in several particulars from the common European form, *Gammarus pulex*, yet I found on it the same ectoparasites, *Dendrocometes paradoxus* Stein and *Callidina parasitica* Giglioli (13).

In a foot-note to his paper Otto states that Professor Rudolph Leuckart who provided him with the material for his study, succeeded in bringing some of the embryos of *Amph. subtriquetrum* to a further stage of development in the Pond Snail, *Planorbis marginatus*.

Cuticle.

The body of *Amph. subtriquetrum* is covered with a smooth, thick cuticle, which is turned in a little way at the genital opening and the excretory pore, and lines the gut as far as the oesophagus. Where it turns in at the body openings, and over the posterior sucker muscle the cuticle is thin; but over the rest of the body it consists of two well defined thick layers. The outer of these stains deeply and appears quite homogeneous; the inner which is more transparent presents a fine radially striated appearance (Figs. 6, 9 & 10). Otto quotes Looss (14) in support of the opinion that these radial markings are merely a result of preservation and have no connection with the muscular system. On the other hand Walter (15) shows them to be the terminal fibrils of the parenchyma muscles. I was able to confirm his observation that the muscles which cross the parenchyma break up, at the level of the circular muscles, into numerous fine threads that appear to be attached to the outer cuticular layer. Poirier

(16) I find figures this arrangement of muscles for two species of *Distomum;* Wright and Macallum (17) also gives it for *Sphyranura Osleri;* and Stafford (18) states that the parenchyma muscles come to the surface to find insertion.

Subcuticular Cells.

The musculature of the body-wall follows directly below the cuticle without the intervention of an epithelial layer (Figs. 6, 9 & 10). Just below the circular muscles in between the longitudinal muscle bundles are the so-called "subcuticular" or "chromatophile" cells. These appear in section as little clumps of large deeply staining nuclei surrounded by a small amount of protoplasm; in horizontal section through these we find that they form a continuous network like tissue. They occur over the whole body: between the muscle fibres of the pharynx and of the posterior sucker, and around the excretory and genital tubes for a short distance from their openings. The oesophagus is surrounded by a dense mass of cells which look as though they might be glandular in nature. However, staining does not distinguish them from the subcuticular cells so I conclude that they are essentially the same. Both the cells around the oesophagus and those below the cuticle show slender necks of protoplasm connected with the inner surface of the cuticle (Figs. 6 & 9). The cells in the pharynx are more separated and show clearly prolongations in various directions which join those from neighbouring cells and so form a net work (Fig. 14).

The nature and function of these "subcuticular" cells has been variously interpreted. The majority of writers consider them to be in some way the matrix of the overlying cuticle. W. B. Beham (19) in Lankester's "Zoology" follows Blochmann (20) and describes them as epidermal cells which have sunk in between the muscle fibres so that only a narrow part of each cell is left in communication with the cuticle. Ziegler (21) considers such an insinking of the epithelium impossible as the layer of subcuticular muscles is fully formed before the disappearance of the outer cell layer of the "Cercaria" larva. Brandes (22) and others call the cells in question true unicellular glands whose function is to secrete the cuticle. In several papers I find them described as the meristematic tissue of the body, (Leuckart (23), Walter (24), Stafford (25)). Looss (26), in one paper described them as remains of embryonic parenchyma with the function of secreting the cuticle. Walter (24) ascribed to them two functions, that of increasing and renewing the parenchyma, and of indirectly nourishing the cuticle. Braun (27) described them as the most

external layer of the parenchyma. This view is set forth in a recent paper by Pratt (28) who draws the conclusions from his study that the subcuticular tissue belongs genetically to the parenchyma and that the cuticle is the peripheral portion of the parenchyma, composed mainly of secretions of it. This last hypothesis offers I think the best explanation of the facts as I have observed them in *Amph. subtriquetrum*. The subcuticular cells are undoubtedly connected everywhere with cuticle, and their protoplasmic net-work on the other hand passes directly into that of the typical parencyhma tissue (Figs. 6, 9 & 10).

Parenchyma.

The parenchyma of *Amph. subtriquetrum* is formed of thin strands of connective tissue which enclose large irregular spaces. These spaces appear filled with a loose coagulum of the body fluid of the living Trematode; and in this flocculent mass are scattered numerous iree nuclei in various stages of degeneration.

At intervals through the parenchyma and especially numerous in the muscles of the pharynx and of the posterior sucker are conspicuous "large" or "giant" cells. Those in the parenchyma occupy various positions. Some are near the circular muscles of the body wall, some lie alongside parenchyma fibres and occasionally I have found them closely approximated to the walls of the body organs. The acetabular cells, i.e., those in the pharynx and sucker muscles, are regularly arranged in zones mid-way between the cuticle and the inner boundaries of the muscles. The layer of "large" cells is more easily distinguished in the pharyngeal muscle, because the fibres there are farther apart, but the cells are as numerous though less distinct in the sucker (Figs. 4, 8 & 12).

The nuclei of the "large" cells are generally oval in shape, bounded by a distinct dark membrane, (Fig. 13). The nuclear contents are granular and a large densely staining nucleolus is present as a rule. In some cases, however, I found the nucleus irregular in outline as though in process of budding off daughter nuclei, and in such cases there were several smaller nucleoli (Figs. 14 & 15). The protoplasm shows thread-like prolongations in all directions which give the outer border of the cell a netted appearance. These long branching fibres of protoplasm show direct connections with the extensions of the subcuticular cells mentioned above. This is especially clear in the acetabular cells of the pharynx (Fig. 14).

At first these "large" cells were almost universally called "Ganglion cells." According to Looss (29) it was Stieda (30) who first

described them as nervous elements, and Lang (31) seemed to prove their connection with the nerves for ectoparasitic forms (*Tristomum*). In Poirer's (32) paper I find them called ganglion cells; Schuberg (33) states that staining with methylene blue shows them to be exactly like nerve cells. Otto (34) also calls them ganglion cells. Looss (29) himself after careful study, concluded that the "grossen zellen" were remains of the original formative cells of the sucker and pharynx from which the muscle fibres differentiated, which wandered in with the growth of the parenchyma cells and together with these formed the connective ground substance of the suckers. Walter (25) described them, both in the body parenchyma and in the suckers, as intermediate stages in the formation of ordinary parenchyma cells, from the subcuticular layer. Leuckart in the "Parisiten des Menschen" called them formative cells of the radial muscles of the suckers. Nicholls (36) calls them "myoblasts," he says they have little in common with the "subcuticular glands," but resemble very nearly nerve ganglion cells. Villot (37) and after him Mace (38) considered the "great" cells as "Dilations vasculaires," or merely sections of vascular, that is excretory tubules (39). Wright and Macallum suggest that they are connected with the excretory system. Braun (40) proposes that they may assist in increasing the elasticity of the organs in which they lie and act especially as "antagonists" to the radial muscle fibres. My own observations lead me to conclude that the "large" cells are remains of embryonic parenchyma cells which have enormously increased in size and like "Giant cells" have lost the power of dividing mitotically but may break up by direct division. As for their function the conflicting views may be partly reconciled by regarding them as myoepithelial cells.

In conclusion I wish to express my sincere thanks to Professor Willey for the help he has so generously given me in my study, and in the final revision of this report of my work.

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Explanation of Illustrations.

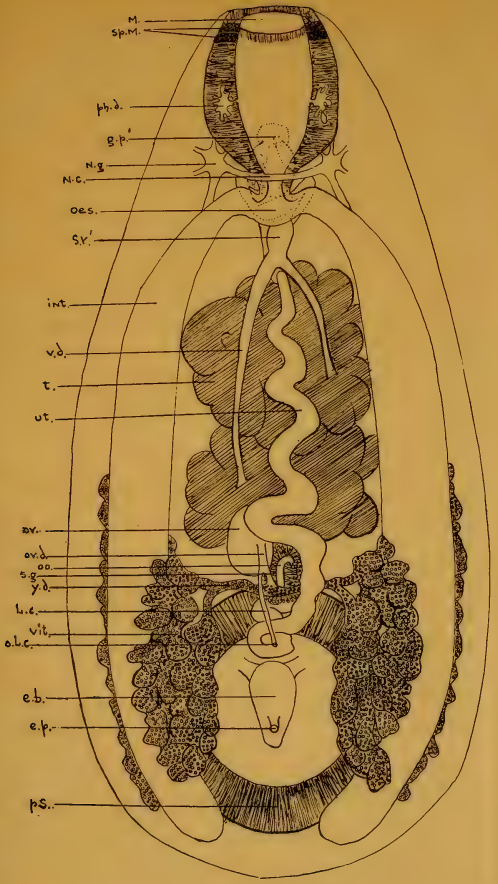
c.	Wall of cirrus sac.
c.m.	Circular muscles.
cut.	Outer layer of cuticle.
d.m.	Diagonal muscles.
d. ejac.	Ductus ejaculatorius.
e.b.	Excretory bladder.
e.p.	Excretory pore.
ex.	Branching extensions of cell.
g.c.	Giant cell.
g.p.	Genital pore.
g.s.	Genital sinus.
int.	Intestine.
L.C.	Laurer's canal.
l.m.	Longitudinal muscles.
m.	Mouth.
n.	Nucleolus.
n.m.	Nuclear membrane.
n.c.	Nerve commissure.
n.g.	Nerve ganglion.
oes.	Oesophagus.
oes. g.	Nucleated cells around oesophagus.
o.l.c.	External opening of Laurer's canal.
oo.	Ootype.
ov.	Ovary.
ov.d.	Oviduct.
par.	Parenchyma.
par.m.	Parenchyma muscle.
ph.	Pharynx.
ph.d.	Diverticulum of pharynx.
p.s.	Posterior sucker.
pr.g.	Prostate gland.
r.m.	Radial muscle of sucker.
s.g.	Shell gland.
s.cut.	Striated inner cuticle.
sp.m.	Sphincter muscle.
sub.c.	Subcuticular cells.

s.v.	Vesicula seminalis.
t.	Testis.
ut.	Uterus.
v.d.	Vas deferens.
vit.	Vitellarium.
y.d.	Yolk duct.

1. Amphistomum subtriquetrum. Diagram to show arrangement of parts; dorsal view.
2. Outlines natural size. A. Dorsal view. B. Side view. C. Ventral view.
3. Terminal part of sperm ducts; dorsal view.
4. Median longitudinal section.
5. Sagittal section of posterior end, showing giant cells in position.
6. Transverse section through middle of pharynx; to show diverticula of pharynx.
7. Transverse section through posterior region of pharynx; to show genital opening.
8. Transverse section through posterior sucker; to show excretory opening.
9. Transverse section of dermal layers, showing prolongations of subcuticular cells to the base of the cuticle.
10. Transverse section of dermal layers, showing attachment of parenchyma muscles.
11. Horizontal section showing net-work of subcuticular cells below the cuticle and circular muscles.
12. Diagram to show various positions in which giant cells were found.
13. Normal giant cell (from the posterior sucker).

14, 15. Giant cells with irregular nuclei (from the pharynx).

1.



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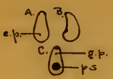

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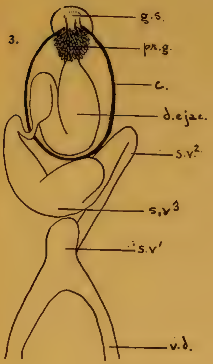
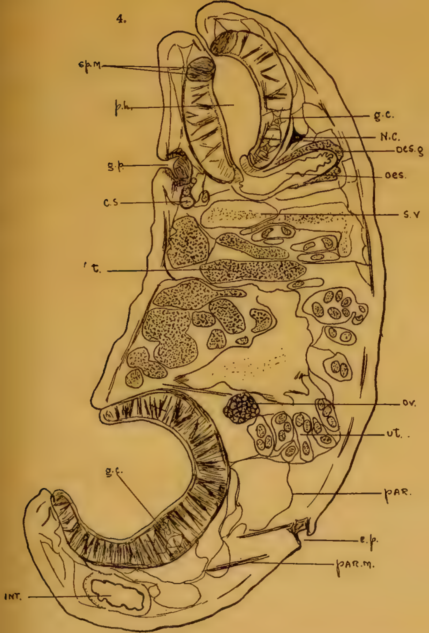


1. Diagram of Amphistomum subtriquetrum. Dorsal view; to show arrangement of parts.
2. Outlines natural size.
3. Terminal part of sperm ducts. Dorsal view.

4.



5.

4. Median Longitudinal Section.
5. Sagittal section of posterior end.

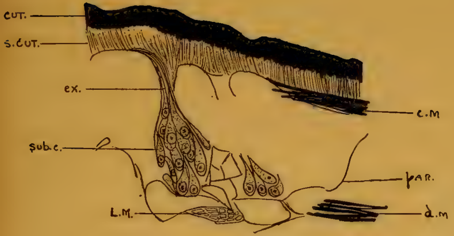
6.

7.

8.

6. Transverse section through mid-pharynx.
7. Section through posterior region of pharynx.
8. Section through posterior sucker.

9.



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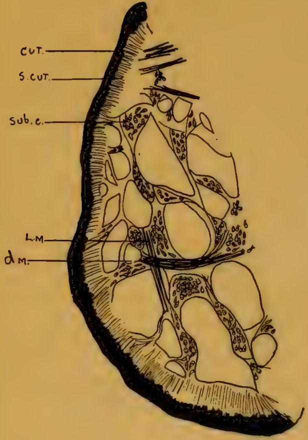

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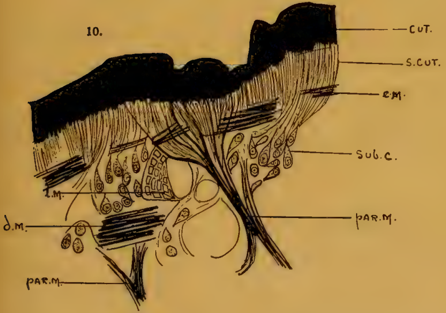
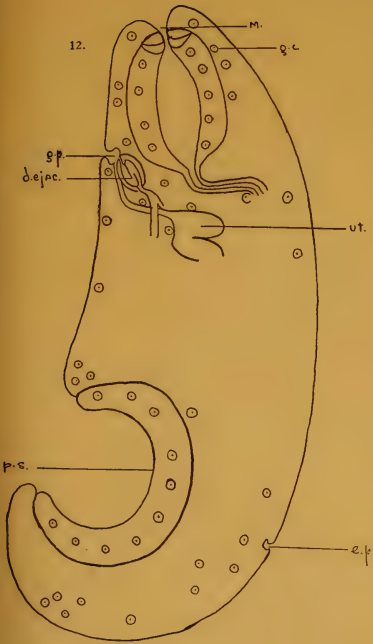


9. Transverse section of dermal layers.
10. The same showing attachment of parenchyma muscles.
11. Horizontal section to show net-work of subcuticular cells.

12.



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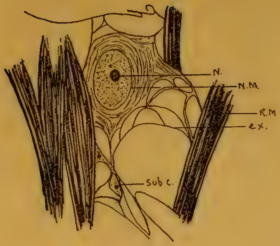

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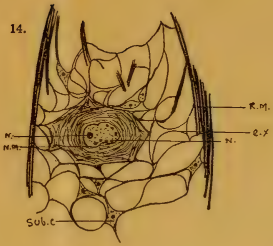

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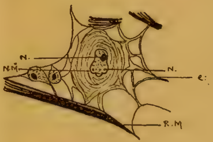

12. Diagram to show positions in which giant cells were found.
13. Typical giant cell.
14. 15. Giant cells with irregular nuclei.

Transactions of The Royal Society of Canada
SECTION IV

SERIES III DECEMBER 1914 VOL. VIII

Some Hydroids of the Vancouver Island Region.

By C. McLean Fraser, Ph.D.

Curator of the Pacific Coast Biological Station, Nanaimo, B.C.

(Presented by A. B. Macallum, Ph.D., F.R.S.C.)

INTRODUCTION.

Although two papers have appeared already on the hydroid fauna of this region, these were principally of value from a distribution standpoint, hence the time now seems opportune to issue a more descriptive paper to include all the species obtained to date with a key to the genera and species, that others who wish to become familiar with the common forms, may do so without finding it necessary to consult a number of papers, all of which are seldom found in a single library. The time seems opportune because within the last few years the waters of the Pacific have been receiving a little more attention and the number of species known is now sufficiently great to form a good basis for further work. A description of these will give one a chance to diagnose the majority of the common forms at least.

Some valuable descriptive papers on material from the west coast have been published but in all cases the number of species described was small, not great enough to include many general species. Calkins' paper gives some full descriptions and is of great value for the restricted area from which his material was obtained. Nutting's two papers and Clark's two papers give descriptions of several species and many species that Torrey has described have been found in this vicinity. Nutting's monographs on the Plumularidæ and the Sertularidæ cover the ground fairly well for these two families. All these papers are referred to in the text and the bibliography.

The present paper is intended to give description and figures of all the species that are known to have been obtained in the region which includes the waters from Puget Sound northward to the Queen Charlotte Islands or in other words the waters in proximity to the Province of British Columbia and the State of Washington.

In all but a few cases the writer has specimens of each in his own collection and the description and figures have been taken directly from these. The drawings are hence all original drawings and unless otherwise stated were taken from material obtained from this region. In a few cases it has been necessary to give description and drawings

from other papers where specimens of species that have been reported were not to hand. Much new material has been obtained since the last paper was written and hence much new information was made available, either concerning species already reported or species not previously mentioned. Most of the new material has been procured by shore collecting and dredging near the Biological Station, all of this within a radius of 25 miles, and scarcely any of it from a depth greater than 30 or 35 fathoms, hence there is room for much more exploratory work even within this area. Through the kindness of Professor Kincaid and his assistants, another large portion has been obtained within a somewhat similar radius of the Friday Harbor Station. Much of this was obtained personally during a stay of two weeks at the Station in July and August, 1912. This was supplemented by specimens from the University of Washington, from an assortment that represented several summers' collection at the Friday Harbor Station. It was possible to examine a great deal of this in a short time at the University since a fine lot of specimens, covering a majority of the species, had been sorted out by Mr. H. Osterud.

For the remainder of the material I am indebted to Dr. J. P. McMurrich, who collected some excellent specimens on one trip north to Prince Rupert, Fort Simpson and Queen Charlotte Islands, and on another trip around Vancouver Island, in which dredging was done at various depths, all in rather shallow water.

The area from which the new material has been obtained is practically the same as that on which a report has already been given but the additional collecting has brought to light 28 species new to this region, 18 of which are new to the coast and 7 are described as new to science, besides which the gonosomes of 6 others have been found for the first time. The total number described in this paper as occurring in this region is 136.

Not only does the hydroid fauna show variety, but the abundance of many of the species, eg. *Lafœa dumosa*, *Lafœa gracillima*, *Sertularella tricuspidata*, *Abietinaria abietina*, *Abietinaria traski*, *Calycella syringa*, *Clytia edwardsi* and *Obelia longissima*, is very noticeable. Variety and abundance are often marked at the same time when conditions are especially favorable. Northumberland Channel at the entrance to Dodds Narrows has been mentioned already as a place where conditions are favorable. The truth of this has been further accentuated as in a single haul with a two-foot hand dredge, made in this locality on May 17, 1912, 36 species of hydroids were obtained. Although this is a record, it is scarcely an isolated case as it is quite a common occurrence to get upwards of 20 species in a couple of hours' dredging. In one instance while dredging in Gabriola Pass a decorat-

ing crab appeared on which were eight species of hydroids belonging to 8 different genera. The species were:—*Syncoryne mirabilis*, *Garveia annulata*, *Campanularia urceolata*, *Clytia edwardsi*, *Gonothyræa gracilis*, *Obelia griffini*, *Halecium parvulum and Plumularia corrugata*, as representative a lot as one could well imagine.

While the descriptions throughout are concise, it has been my endeavor to make them include all the salient features. When they are taken in connection with the figures they should be sufficient to lead to the diagnosis of the majority of specimens. Naturally there will be some intergrading forms as in species of all nearly related groups of animals and plants in which the diagnosis will be largely a matter of individual opinion.

The enlarged drawings, which, as in my other papers, have been made by my wife, are all made to the same scale unless otherwise indicated and for that reason, unless in exceptional cases, comparative measurements have been considered unnecessary. As in some cases the general appearance, more than anything else, serves to distinguish nearly allied species, it has been thought advisable to include sketches to show the natural size of a specimen, or a part of it, of each species. Since these are freehand they are naturally not so exact as the camera-lucida drawings but nevertheless they may be of some service in diagnosis.

To all those mentioned as having given valuable assistance I wish to express my sincere thanks.

GEOGRAPHIC DISTRIBUTION

A lengthy discussion of distribution in this paper is scarcely necessary as in the West Coast paper distribution was given much attention and, as the whole coast was considered, a greater number of species was included in the discussion than are described in the present paper.

Further investigation has corroborated the majority of the conclusions then set forth. A word regarding the species now reported from this region for the first time will be sufficient to indicate this. Of the 28 species that come under this head, 7 are described as new. These are:—*Corydendrium fruticosum*, *Coryne crassa*, *Campanularia longitheca*, *Obelia multidentata*, *Ophiodes gracilis*, *Thuiaria distans* and *Cladocarpus vancouverensis*. Of the remainder, 10 have been reported from other points along the west coast, three of them, *Eudendrium rameum*, *Selaginopsis triserialis* and *Sertularella pedrensis*, from points south of this region, and the remainder, *Tubularia indivisa*, *Campanularia regia*, *Gonothyræa inornata*, *Stegopoma plicatile*, *Hale-*

cium reversum, *Abietinaria turgida* and *Sertularella albida*, from points to the north. The remaining 11 are new to the coast. *Opercularella lacerata* has been reported from Eastern North America, Arctic Regions, Europe and the South Pacific: *Eudendrium tenellum*, *Gonothyræa gracilis*, *Halecium labrosum* and *Grammaria abietina*, from Eastern North America, the Arctic Region and Europe: *Halecium articulosum* from Eastern North America and Europe: *Hybocodon prolifer* and *Clytia cylindrica* from Eastern North America: *Garveia grœnlandica* from the Arctic Regions: *Eudendrium insigne* from Europe and *Halecium flexile* from the South Atlantic.

These species now reported, supplementing those already reported, show more conclusively than ever that there is no great lack of continuity in the hydroid fauna at any point along the west coast. They also give further indication of the close relationship existing between the forms on this coast, on the east coast of North America, the Arctic regions and Europe.

Of the families represented in the Vancouver Island Region, the *Sertularidæ* leads the lists with 60 species but the *Campanularidæ* comes fairly close with 34. There are 16 of the *Halecidæ*, 8 of the *Campanulinidæ*, 7 of the *Lafœidæ* and of the *Plumularidæ*, while all the gymnoblastic species number but 24. As indicated in the introduction no deep water collecting of any account has been done. Possibly when the fauna of greater depths has been examined there may be quite a difference in the proportion. Commonly the *Sertularidæ* maintain an even greater proportion at greater depth. This is indicated as compared with the *Campanularidæ* at least by the proportion the shore forms bear to the whole number collected. Of the 38 species that have been found at the shores at low tide, there are 5 gymnoblastic forms, 16 belonging to the *Campanularidæ*, 2 to the *Campanulinidæ*, 3 to the *Halecidæ*, 2 to the *Lafœidæ*, 7 to the *Sertularidæ* and 3 to the *Plumularidæ*.

The species so found were:—*Syncoryne mirabilis*, *Garveia annulata*, *Eudendrium californicum*, *Hydractinia milleri*, *Tubularia crocea*, *Campanularia denticulata*, *Campanularia everta*, *Campanularia exigua*, *Campanularia grœnlandica*, *Campanularia urceolata*, *Clytia edwardsi*, *Clytia inconspicua*, *Clytia johnstoni*, *Eucopella caliculata*, *Gonothyræa clarki*, *Gonothyræa gracilis*, *Obelia dichotoma*, *Obelia dubia*, *Obelia gracilis*, *Obelia longissima*, *Obelia surcularis*, *Calycella syringa*, *Opercularella lacerata*, *Halecium annulatum*, *Halecium densum*, *Halecium wilsoni*, *Lafœa dumosa*, *Lafœa gracillima*, *Abietinaria amphora*, *Abietinaria anguina*, *Abietinaria filicula*, *Abietinaria greenei*, *Sertularella conica*, *Sertularella turgida*, *Thuiaria dalli*, *Aglaophenia struthionides*, *Plumularia lagenifera*, *Plumularia setacea*.

Many of those although occasionally found at low tide are much more commonly found in the water at various depths. By far the commonest shore form in the neighborhood of the Station is *Obelia longissima*, which grows on floats, piles, etc., in great masses. It is present practically the whole year through and liberates medusæ through an extended period. *Gonothyræa clarki* is plentiful in spring and early summer but later seems to die off. *Syncoryne mirabilis* is common in spots and the medusæ, commonly called *Sarsia mirabilis*, are extremely plentiful in the early summer. After these are liberated the hydroid dies off and nothing is seen of it later in the year.

The majority of the others can scarcely be said to be common above low tide mark along any shores visited. Rather the upper limit of their bathymetrical range is near that mark and at very favorable tides, a few specimens may appear out of water or within reach below the surface. Many that are not included in this list are found in quite shallow water and it may be a matter of accident that some of them have not been found at low tide as well. Practically all the specimens have been got at a depth that may be considered slight in comparison with the depth of the water farther out in the Strait of Georgia or out some distance from the shore in the open ocean.

The accompanying table will serve to give an idea of the relative number of species that have been found in districts in the region, which although convenient for enumeration, are of necessity somewhat arbitrarily chosen. Naturally the east coast of Vancouver Island and the San Juan Archipelago show the largest numbers as the greatest amount of work has been done here, but from the little collecting that has been done on the west coast of the island and the region to the northward, they promise particularly well. Such localities as Swiftsure Shoal on the west coast and Nawhitti Bar to the north of the Island, as well as other points that might be mentioned, will doubtless yield as great a variety as any similar areas that have been investigated.

As the occurrence of each species is written up as completely and precisely as possible, it would be of no special value to go into detail here concerning the relative abundance of the different species in the various families.

TABLE OF DISTRIBUTION

	B. C. North of Vancouver I.	West Coast of Vancouver I.	East Coast of Vancouver I.	San Juan Archipelago	Puget Sound	West Coast of N.A. South of B. C.	West Coast of N.A. North of B. C.
Endocrypta huntsmani			—	—			
Corydendrium fruticosum			—	—			
Coryne crassa				—			
Syncoryne mirabilis	—		—	—	—	—	
Bimeria gracilis			—			—	
Bimeria robusta				—		—	
Garveia annulata	—	—	—	—		—	—
Garveia grœnlandica	—	—	—	—			
Bougainvillia glorietta			—			—	
Bougainvillia mertensi			—				
Perigonimus repens			—		—		
Eudendrium californicum		—	—				
Eudendrium capillare				—			
Eudendrium insigne		—	—				
Eudendrium rameum		—		—		—	
Eudendrium tenellum			—				
Eudendrium vaginatum		—					—
Hydractinia aggregata				—			
Hydractinia milleri		—				—	
Tubularia crocea	—		—	—		—	
Tubularia harrimani		—		—			
Tubularia indivisa	—		—				
Tubularia larynx			—	—			
Hybocodon prolifer			—				
Campanularia denticulata			—	—		—	—
Campanularia everta						—	
Campanularia exigua					—		
Campanularia fusiformis			—				
Campanularia gelatinosa			—	—	—		
Campanularia grœnlandica	—	—	—	—	—		
Campanularia integra			—	—			—
Campanularia longitheca			—				
Campanularia raridentata	—		—	—			
Campanularia regia	—			—			

TABLE OF DISTRIBUTION—*Continued*

	B. C. North of Vancouver I.	West Coast of Vancouver I.	East Coast of Vancouver I.	San Juan Archipelago	Puget Sound	West Coast of N.A. South of B. C.	West Coast of N.A. North of B. C.
Campanularia speciosa			—	—			
Campanularia urceolata	—	—	—	—	—		
Campanularia verticillata	—	—	—	—	—	—	—
Campanularia volubilis	—		—	—		—	
Clytia attenuata				—			
Clytia cylindrica				—			
Clytia edwardsi			—	—	—	—	
Clytia inconspicua			—	—	—		
Clytia johnstoni		—	—		—		
Clytia kincaidi					—		
Eucopella caliculata					—		
Gonothyræa clarki						—	—
Gonothyræa gracilis							
Gonothyræa inornata							—
Obelia borealis							—
Obelia dichotoma					—		
Obelia dubia		—		—			
Obelia fragilis					—		
Obelia gracilis				—	—		
Obelia griffini			—		—		
Obelia longissima		—	—		—		—
Obelia multidentata							
Obelia plicata			—				
Obelia surcularis							
Calycella syringa			—			—	—
Campanulina forskalea							
Campanulina rugosa					—		—
Cuspidella grandis							
Cuspidella humilis				—			
Lovenella producta							
Opercularella lacerata			—				
Stegopoma plicatile			—				—
Halecium annulatum			—			—	
Halecium articulosum					—		

TABLE OF DISTRIBUTION—*Continued*

	B. C. North of Vancouver I.	West Coast of Vancouver I.	East Coast of Vancouver I.	San Juan Archipelago	Puget Sound	West Coast of N.A. South of B. C.	West Coast of N.A. North of B. C.
Halecium corrugatum		—	—	—	—		
Halecium densum	—	—	—	—	—		
Halecium flexile			—	—			
Halecium halecinum		—			—		—
Halecium kofoidi				—		—	
Halecium labrosum			—				
Halecium parvulum	—	—	—	—			
Halecium pygmæum	—			—			
Halecium reversum			—				—
Halecium scutum				—			—
Halecium tenellum	—	—	—	—		—	
Halecium washingtoni			—	—	—	—	
Halecium wilsoni		—	—	—	—		
Ophiodes gracilis	—		—				
Filellum serpens			—	—			—
Grammaria abietina		—	—	—			
Grammaria immersa			—				—
Lafœa dumosa	—	—	—	—	—		—
Lafœa fruticosa	—	—	—	—	—		—
Lafœa gracillima	—	—	—	—	—	—	—
Lictorella carolina				—			
Abietinaria abietina	—	—	—	—	—	—	—
Abietinaria amphora		—	—	—	—	—	—
Abietinaria anguina	—	—	—			—	—
Abietinaria filicula			—	—	—		—
Abietinaria gigantea					—		—
Abietinaria gracilis		—	—				
Abietinaria greenei		—	—	—		—	
Abietinaria rigida			—	—	—		
Abietinaria traski	—	—	—	—	—	—	
Abietinaria turgida			—	—	—		—
Abietinaria variabilis	—	—	—	—	—		—
Dictyocladium flabellum		—					
Diphasia pulchra			—				

TABLE OF DISTRIBUTION—*Continued*

	B. C. North of Vancouver I.	West Coast of Vancouver I.	East Coast of Vancouver I.	San Juan Archipelago	Puget Sound	West Coast of N.A. South of B. C.	West Coast of N.A. North of B. C.
Hydrallmania distans	—	—	—	—	—		
Selaginopsis cylindrica	—		—	—	—		—
Selaginopsis hartlaubi				—			—
Selaginopsis mirabilis			—	—	—		—
Selaginopsis pinnata	—		—	—			—
Selaginopsis triserialis			—	—		—	
Sertularella albida				—			—
Sertularella conica		—	—	—	—		
Sertularella pedrensis	—		—			—	
Sertularella pinnata			—	—		—	—
Sertularella polyzonias		—	—	—			—
Sertularella rugosa			—	—	—		—
Sertularella tanneri		—					
Sertularella tenella	—	—	—	—	—	—	—
Sertularella tricuspidata	—	—	—	—	—	—	—
Sertularella turgida		—	—	—	—	—	
Sertularia furcata		—				—	
Thuiaria alba			—	—	—		
Thuiaria argentea	—		—	—		—	—
Thuiaria dalli	—		—	—	—	—	—
Thuiaria distans			—				
Thuiaria fabricii			—	—	—	—	—
Thuiaria robusta		—					
Thuiaria similis	—	—	—	—	—		—
Thuiaria tenera					—		
Thuiaria thuiarioides	—	—			—	—	—
Thuiaria thuja	—			—			—
Aglaophenia latirostris					—	—	
Aglaophenia struthionides	—	—	—	—	—	—	—
Cladocarpus vancouverensis			—				
Plumularia corrugata			—	—			
Plumularia goodei		—	—	—	—	—	
Plumularia lagenifera	—	—	—	—	—	—	—
Plumularia setacea		—	—	—	—	—	

SYSTEMATIC DISCUSSION

The method of classification in this paper does not differ in any respect from that heretofore used. The characteristics of each family and genus are included that the paper itself may be self-contained but in giving these very little change has been made from those given elsewhere.

The genus *Corydendrium*, which I have not previously obtained, is used in a different sense to that expressed by some other authors, but an explanation for this is given in the discussion of the genus itself. *Thaumantias* as a hydroid genus seems indistinguishable from *Clytia* and has been dropped.

A better supply of material has necessitated a change of opinion in the case of some of the species. *Diphasia claræ* has turned out to be a young *Hydrallmania distans*. *Calycella pygmæa* appears to be but a small *Calycella syringa*. *Campanularia pacifica* and *Obelia gelatinosa* are doubtless the same species. *Filellum expansum*, which has been always considered doubtful, is more so with present day evidence hence it has not been included.

Further evidence makes it more conclusive that *Selaginopsis plumiformis* is not distinct from *S. cylindrica*, that *Sertularella dentifera* is not distinct from *S. tricuspidata* and that *Plumularia palmeri* is not distinct from *P. lagenifera*, hence the former in each of these cases has been left out of the list. In all cases mention is made of these points in the description of the genus or species.

As in the West Coast paper a complete synonymy, as far as papers bearing on the district are concerned, was given for all species mentioned, it seems unnecessary to repeat this but a page reference to this paper is given in each case where the species has already been reported. Besides this the original reference is always given and in some cases when other papers are mentioned in the discussion this reference is also included in the synonymy. When the species has not previously been reported from this coast, the original reference is given as well as other references to well known papers if such references are available.

Sub-order **GYMNOBLASTEA**

Hydroids with hydranths unprotected by hydrothecæ and gonophores unprotected by gonangia or other structures serving a similar purpose.

Family **Turridæ**

Trophosome.—Hydranths with scattered filiform tentacles.

Gonosome.—Gonophores giving rise to free medusæ with simple radial canals and simple marginal tentacles.

Genus **ENDOCRYPTA**

Trophosome.—Hydrorhiza of small fibres or almost entirely degenerated. The perisarc which envelopes the hydrocaulus also unites one with the others, this being in the nature of a very fine encrustation. Hydranths claviform.

Gonosome.—Gonophores producing free medusæ with four radial canals and four simple marginal tentacles.

Endocrypta huntsmani (Fraser)

Pl. I, Fig. 1.

Crypta huntsmani FRASER, West Coast Hydroids, 1911, p. 19.

Endocrypta huntsmani FRASER, Science, vol. XXXV, 1912, p. 216.

Endocrypta huntsmani FRASER, Hydroids from Vancouver Island, 1913, p. 149.

Trophosome.—Hydrocaulus tubular, in most cases erect and unbranched, but occasionally it branches or more correctly forks as the two parts seem to be of equal significance and seldom differ much in size. The two parts of the fork may remain in an upright position forming a very acute angle, or one or both may turn very much from the perpendicular and the one may turn from the other until they get in exactly opposite directions. The erect hydrocaulus may reach a height of 8 mm. The perisarc is so thin as to be a mere pellicle, that part which forms the basal expansion being particularly so. In the young colony the hydrorhiza consists of a network of fine fibres, but these appear to degenerate in the older forms so that when a single individual is separated from the colony it pulls out like a fungus with a portion of the mycelium attached. The hydranth appears much darker than the hydrocaulus. When at rest it is usually club-shaped but it has extreme mobility. The mouth may be opened so that the proboscis is trumpet-shaped or it may be averted and reflexed entirely so that it is folded back over the base of the tentacles, these also being turned backward to point towards the base. In such a case the extremity is shaped like a strawberry with the tentacles projecting like the calyx-teeth and the bases showing through the wall like the seeds on the receptacle. In some cases the tentacles appear to be arranged in fairly definite rows but more

commonly there is no regularity in the arrangement. In the young forms they may be very few in number but as development proceeds the number is increased until there may be as many as 24 present.

Gonosome.—Medusa buds, from 1 to 3, usually 2, are developed a short distance below the tentacles. Before the medusæ are liberated the tentacles have grown to a length equal to about half of the diameter of the bell and the four radial canals are quite distinct. The free medusæ (about 2 mm. in diameter at the time of liberation), are nearly globular in shape with an extensive velum. The red manubrium may reach to the opening of the bell or even beyond it. It is of greater diameter at the base than at the extremity. The tentacles are each provided with a distinct cap. The umbrella is extensively pitted.

Color.—Pale pink.

Distribution.—Departure Bay (Fraser); Nanoose Bay, near Clarke Rock, Departure Bay, off Protection I., Friday Harbor.

As stated in previous papers this species has been found only within the branchial cavity of certain ascidians, attached to the peribranchial wall. They are not confined to individuals of the same species, however, as Dr. Huntsman records[1] specimens in *Phallusia ceratodes*, *Ascidiopsis paratropa*, *Ciona intestinalis* and *Tethyum aurantium*.

Many good specimens have been obtained and the development has been traced until the medusæ were liberated but no medusæ were found large enough to possess even an indication of gonads, consequently there is no certainty as to the size when they leave the ascidian, as they surely must do, and no information whatever as to how or why the planulæ seek such a base for attachment when the proper time arrives. In the case of the majority of hydroids apparently anything solid will serve for such attachment but in this species there appears to be a high specialization in that regard.

No specimens have been found earlier than June 5. At this time there were small individuals with small tentacles 4 or 5 in number, but many were full grown with medusa-buds well developed. Colonies obtained on October 17 contained no very young individuals but some of the medusa-buds were still small while others were fully developed and the medusæ were being set free.

Family **Clavidæ**

Trophosome.—Hydranths with scattered filiform tentacles.

Gonosome.—Gonophores producing sexual products in fixed sporosacs.

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[1] Ascidians from the coasts of Canada. Trans. Canadian Inst., 1911, p. 116.

Genus CORYDENDRIUM

Trophosome.—Stems fascicled and branched, hydranths with scattered filiform tentacles.

Gonosome.—Gonophores borne on stems or branches in the form of fixed sporosacs.

For some time this genus was known only by the species *parasiticum* described by Linnæus as *Sertularia parasitica*,[2] and placed in the genus *Corydendrium* by van Beneden[3]. Allman, getting the impression from Cavolini's description that the species produced free medusæ, placed it in the family *Turridæ*[4]. Later Weismann showed that the species did not produce free medusæ.[5]

When Nutting worked out the hydroids obtained during the Hawaiian expedition he found two new species both of which he called *Corydendrium*.[6] In the one case, *C. corrugatum*, he found no gonosome, but in the other *C. minor*, he found medusa-buds. The presence of free medusæ made it impossible to include this species in the family *Clavidæ* as defined by Allman but the difficulty was surmounted by including in the family *Clavidæ* forms that produced free medusæ as well as those that produced fixed sporosacs, both represented in the genus *Corydendrium*.

Later Thornely, without any reference to Nutting's paper, described a species from the Gulf of Manaar, using the name *Corydendrium chevalense*.[7]

This species had medusa-buds and hence corresponded to Nutting's species *C. minor*, but it was placed in the family *Turridæ* and not in the family *Clavidæ*.

It appears unusual to include in one genus forms that produce free medusæ and those that do not and I do not think it advisable to do so. Since the term *Corydendrium* was first applied to *C. parasiticum* which according to Weismann does not produce free medusæ, the genus should be retained for such species only that produce fixed sporosacs. The medusa *Turritopsis nutricula* McCrady is developed from a hydroid with trophosome of similar structure to that of *Corydendrium* as shown in my Beaufort paper[8], and as far as I can make out from the descriptions and figures of Nutting and Thornely there is every

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[2] Syst. Nat., 1767, p. 1315.

[3] Sur les genres Eleuthérie et Synhydre, 1844. p. 313.

[4] Ray Society, 1871, p. 262.

[5] Die Entstehung der Sexualzellen bei den Hydromedusan, 1888, p. 40.

[6] Hydroids of the Hawaiian Islands, 1905, p. 941.

[7] Pearl oyster fisheries of the Gulf of Manaar, 1904, p. 109.

[8] Hydroids of Beaufort, N. C., 1912, p. 345.

indication that the medusæ of *C. minor* and *C. chevalense* are sufficiently similar to that of *T. nutricula* to be placed in the same genus. In this way we should have *Corydendrium parasiticum* and possibly *C. corrugatum* but *Turritopsis minor and T. chevalense.*

I have been unable to find the gonosome of a species that seems rather common in this region and consequently am unable to state definitely to which genus it belongs. It is placed temporarily with the genus *Corydendrium* but when the gonosome is obtained a change may be necessary.

? **Corydendrium fruticosum** new species

Pl. II, Fig. 2

Trophosome.—Colony consisting of a short, thick, much fascicled stem, which gives rise to a tuft of rather long branches of nearly the same length, up to 3 cm. These branches seldom give off other branches but pass out almost straight, fascicled more or less throughout and decreasing very little in size. The hydranths, which are supported on short pedicels, usually come off in nearly opposite pairs, but sometimes they are found singly. These pairs are seldom far apart but become more crowded distally. The thick perisarc forms a heavy tube around the pedicel of the hydranth so that the end of it is very noticeable. The hydranth when fully developed is of large size and is provided with 12–15 tentacles that have no very definite arrangement.

Gonosome.—Unknown.

Color.—There is no distinctly marked color in the stem and even the hydranths are very pale although there is a slight indication of pink or flesh color.

Distribution.—Most abundant in material obtained in 40–60 fathoms outside of Brown Island, Friday Harbor, but also found near Snake I and in Northumberland Channel in 20–30 fathoms.

Family **Corynidæ**

Trophosome.—Colony branched or unbranched. Hydranths club-shaped with scattered capitate tentacles.

Gonosome.—Gonophores producing fixed sporosacs.

Genus **CORYNE**

Trophosome.—Colony branched or unbranched. Hydrorhiza of creeping filiform tubes and the stems and branches invested with a thick perisarc. Hydranths club-shaped with scattered capitate tentacles.

Gonosome.—Sporosacs developed from the body of the hydranth among, or just proximal to, the tentacles.

Coryne crassa new species

Pl. II, Fig. 3

Trophosome.—Colony slightly and irregularly branched, branches reaching to a height of 15 mm. The branches come from the stem at a wide angle and are constricted at the base; stem and branches practically the same size throughout; perisarc thick with but few annulations. Hydranths large with from 20 to 25 rather short tentacles, scattered without any very definite arrangement in rows. The most distal tentacles are farther from the extremity of the proboscis than is usual in this genus.

Gonosome.—Several sporosacs, as many as 8 or 10, are developed from the body just below or just above the proximal tentacles. Female sporosacs large with few large ova, male not so large as the female but still of good size. Very often the majority of the sporosacs develop on the one side of the hydranth and give it a distorted appearance.

Color.—Stem and branches horn color, sporosacs flesh color as are also the hydranths but these are fainter, spadix of thin blood color or in some cases pink.

Distribution.—Friday Harbor.

In general appearance this species resembles *Syncoryne mirabilis* very much but it is stouter and has larger hydranths than that species. It is quite unlike *Coryne brachiata*, the only other *Coryne* recorded from the west coast, as that species is very strongly annulated, has much smaller sporosacs and more numerous ova.

Family **Syncorynidæ**

Trophosome.—Hydranths club-shaped with numerous scattered capitate tentacles.

Gonosome.—Gonophores, borne on the body of the hydranth, give rise to free medusæ with four radial canals and four marginal tentacles, some or all of which may be rudimentary.

Genus **SYNCORYNE**

Trophosome.—Colony unbranched or slightly branched, perisarc well developed, tentacles strongly capitate.

Gonosome.—Gonophores usually few in number; medusæ with four rudimentary tentacles.

Syncoryne mirabilis (Agassiz)

Pl. II, Fig. 4

Coryne mirabilis Agassiz, L., Cont. Nat. Hist. U.S., vol. IV, 1862, p. 185.

Coryne rosaria Agassiz, A., III, Cat., 1865, p. 176.

Syncoryne mirabilis Fraser, West Coast Hydroids, 1911, p. 21.

Trophosome.—Colony unbranched or slightly and irregularly branched; stem and branches similar in size; perisarc smooth; hydranth body stout for its length; tentacles 15 or more, stout, strongly capitate.

Gonosome.—Gonophores borne among or below the proximal tentacles; medusæ become sexually mature before liberation.

Color.—Stem and branches horn color, hydranths rose red.

Distribution.—Gulf of Georgia (A. Agassiz); Puget Sound (Calkins); Bare Island (Hartlaub); San Juan Archipelago, Queen Charlotte Is. (Fraser). On float at station, Five Finger Islands, Pylades Channel, Gabriola Pass, Porlier Pass, off Matia I., Puget Sound.

In young specimens the tentacles in some cases at least, develop in regular sets of four each, making the hydranth when fully extended, resemble that of *Stauridium productum* Hincks but in the older individuals all traces of this regularity is usually lost.

The medusæ, known as *Sarsia mirabilis*, are especially abundant around the station float through a portion of the summer months.

Family **Bimeridæ**

Trophosome.—Hydranths with conical or dome-shaped proboscis, surrounded by a single whorl of filiform tentacles.

Gonosome.—Gonophores producing fixed sporosacs.

Key to genera of Bimeridæ found in the V. I. region

A. Gonophores on very short pedicels, sporosacs permanently surrounded by perisarc .... *Bimeria*

B. Gonophores on branch-like pedicels, sporosacs not permanently surrounded by perisarc .... *Garveia*

Genus **BIMERIA**

Trophosome.—Colony branched, invested with a conspicuous perisarc; hydranths fusiform; perisarc covering the base of the tentacles.

Gonosome.—Sporosacs covered with perisarc throughout whole period of development, arising from the stem by means of very short pedicels.

Key to species of *Bimeria* found in the Vancouver I. region.

A. Branches slender, but little wrinkled .... *B. gracilis*

B. Branches stout, wrinkled throughout .... *B. robusta*

? **Bimeria gracilis** Clark

Pl. IV, Fig. 7

Bimeria gracilis CLARK, Hydroids of the Pacific Coast, 1876, p. 252.

Bimeria gracilis TORREY, Hydroids of San Diego, 1904, p. 6.

Bimeria gracilis FRASER, West Coast Hydroids, 1911, p. 22.

Trophosome.—Stem fascicled, growing from a creeping hydrorhiza, reaching a height of 35 mm.; branches rather short and delicate, seldom spreading but taking nearly the same direction as the stem; perisarc mostly smooth but slightly ringed or wrinkled at the base of each pedicel; hydranth with 10–11 tentacles.

Gonosome.—Gonophores borne on the branches singly or in pairs; sporosacs oval; pedicel short, almost suppressed.

Color.—Very little color apparent in either stem or hydranth.

Distribution.—Nanoose Bay, off Clarke Rk., off West Rocks, Dodds Narrows, Gabriola Pass, Gabriola Reefs, Ruxton Passage.

The specimens obtained do not show the annulations at the base of the pedicels so distinctly as indicated by Clark but apart from this they answer to his description and I have little doubt that they belong to the same species.

Bimeria robusta Torrey

Pl. III, Fig. 5

Bimeria robusta TORREY, Hydroida of the Pacific Coast, 1902, p. 29.

Bimeria robusta FRASER, West Coast Hydroids, 1911, p. 22.

Trophosome.—"Hydrorhiza encrusting; stems and larger branches stout, polysiphonic. Colony may be 13 cm. long, largest branches 4 cm., or even 6 cm. long. The latter arise irregularly; hydranth pedicels from these or from secondaries which are always short (6–8 mm.) and may bear 2–4 hydranths; all branches rather closely associated; perisarc wrinkled throughout, investing the hydranth body and possibly the base of the tentacles. Hydranths fusiform with conical proboscis, the largest with 11 tentacles, rarely 12, in one case 16. Five tentacles are longer and often stouter than the others, subequal, suberect and belong to the first whorl. The tentacles of the second whorl alternate with these, are shorter, subequal and bend downward." (Torrey).

Gonosome.—Unknown.

Distribution.—San Juan Archipelago (Fraser).

In working up the material for my west coast paper I found some specimens from San Juan Archipelago which I believed belong to this species. I have not these at hand now nor have I obtained others, hence I have given Torrey's original description and have also shown his figures.

Genus **GARVEIA**

Trophosome.—Colony branched or unbranched; perisarc conspicuous reaching well up on the fusiform hydranth.

Gonosome.—Gonophores borne on distinct branch-like pedicels. The sporosacs may be temporarily enclosed in thin perisarc but this bursts off in the later stages so that the perisarc is confined to the pedicels where it usually ends in a cup-like expansion.

Torrey combined the genus *Garveia* with *Bimeria* under the name *Bimeria*. He gave as his reason that in *Garveia annulata* Nutting he found cases where there was a perisarc envelope over the sporosac which resembled to some extent the perisarc envelope in *Bimeria* and since the difference in the envelope is one of the diagnostic points of difference he thinks that the genera should not be separated.

There is no doubt that in the early stages of the development of the sporosacs there is such an envelope that soon ruptures and leaves the cup-like expansion of perisarc below the sporosac, but Torrey cites no instance where the envelope of the sporosac of a *Bimeria* ruptures in this way. Instead of doing so it remains thick until the contents have matured.

Levinsen observed the breaking down of the thin perisarcal covering in the sporosac of *Garveia grœnlandica*[9] and Allman indicates that something like that has taken place in his drawing of *Garveia nutans*.[10] Torrey minimizes the differences between the pedicels of the gonophores in the two genera. In general appearance there is not much resemblance. In the case of the perisarc on the hydranth there may be a gradation shown in *G. annulata* but in the great majority of cases the perisarc appears to be confined to the base of the hydranth. Taking all these points into consideration I am of the opinion that it is more satisfactory to keep the two genera separate.

Key to species of *Garveia* found in the Vancouver I. region.

A. Stem fascicled, branches and pedicels stout.........*G. annulata*

B. Stem simple, pedicel slender.................... *G. grœnlandica*

[9] Meduser, Ctenophorer og-ydroider fra Groenlands Vestkyst, 1893, p. 155.

[10] Ray Society, 1871.

Garveia annulata Nutting

Pl. III, Fig. 6

Garveia annulata NUTTING, Harriman Hydroids, 1901, p. 166.
Bimeria annulata TORREY, Hydroida of the Pacific Coast, 1912, p. 28.
Garveia annulata FRASER, West Coast Hydroids, 1911, p. 22.

Trophosome,—Stem fascicled but the various parts that go to make it up are more lightly held together than is usual in a polysiphonic stem. Sometimes branches, that give rise to two or more pedicels, come off the main stem but more commonly the pedicels arise directly from it. The whole colony may reach a height of 50 mm. The pedicels vary much in length and in the amount of their annulation; some of them are regularly annulated throughout while others are wrinkled rather than annulated. There is little regularity in their arrangement or in their attitude as compared with the stem. The hydranth is large, fusiform, with the base enclosed in perisarc, which extends to the base of the tentacles; they are about 16 in number.

Gonosome.—The gonophores are borne on the stem and on the stolon. The pedicel is branch-like, covered with thick perisarc which ends in a shallow cup-like expansion below the sporosac, the remains of a ruptured sporosac envelope. The sporosac is large, oval or nearly globular.

Color.—Hydranths and pedicels are light orange, main stem and sporosacs a deeper orange.

Distribution.—Port Renfrew, Ucluelet, Queen Charlotte Is. (Fraser); Clayuquot Sound, Northumberland Channel, Dodds Narrows Gabriola Pass, Whaleboat Passage, off Shaw I., San Juan Channel, Friday Harbor. Very abundant in the neighbourhood of Friday Harbor, particularly off Point Richardson.

This species is very generally found growing through or on a species of sponge. It is much overgrown with other hydroids, especially with *Campanularia urceolata.*

Garveia grœnlandica Levinsen

Pl. IV, Fig. 8

Garveia grœnlandica LEVINSEN, Meduser, Ctenophorer og Hydroider fra Grœnlands Vestkyst, 1893, p. 155.

Trophosome.—Stems arising from a reticulated stolon, simple, usually unbranched but sometimes a main stem gives rise to two or three branches each similar to the unbranched stem; much more delicate than *Garveia annulata*; pedicels vary in length from 2 to 6 mm.; perisarc wrinkled or somewhat irregularly annulated, passing

over the body of the hydranth to the body of the tentacles; tentacles 10 in number.

Gonosome.—Gonophores borne on the stolon; sporosacs, oval or globular borne on distinct pedicels, nearly as long as the vertical diameter of the sporosacs. The sporosac is at first covered with thin perisarc which is like a thin sack, but this soon ruptures, leaving a somewhat wrinkled or flapped portion to form the cup at the base of the sporosac. Unlike *G. nutans*, the peduncle of the sporosac is very short so that the base of the sporosac is but a short distance above the cup-like prominence on the perisarc of the pedicel.

Color.—Stem inconspicuous, hydranth yellowish-green.

Distribution.—Dodds Narrows, Gabriola Pass, Gabriola Reefs, Whaleboat Passage, Swiftsure Shoal, off Matia I., off O'Neale I., Pt. Townshend.

Levinsen, in the original description of this species, gave no figures and hence it is difficult to be sure that one has the same species, even if it answers exactly to his description. Nutting reports *G. nutans* from the Alaskan coast,[11] but these specimens certainly do not belong to that species as *G. nutans* is a much coarser species with a much branched stem and the peduncle of the sporosac is considerably elongated.

Family **Bougainvillidæ**

Trophosome.—Hydranths fusiform or clavate; proboscis conical or dome-shaped; tentacles filiform but somewhat short and rigid, in one whorl around the base of the hydranth body.

Gonosome.—Gonophores producing free medusæ.

Key to the genera of Bougainvillidæ in the Vancouver I. region.

A. Colony much branched; medusæ with clusters of tentacles *Bougainvillia*

B. Colony unbranched or sparingly branched; medusæ with tentacles arranged singly .... *Perigonimus*

Genus **BOUGAINVILLIA**

Trophosome.—Colonies fascicled, much branched; perisarc well developed on stem and branches; hydranths fusiform, proboscis dome-shaped or conical.

Gonosome.—Gonophores supported on short pedicels; medusæ with four radial canals and four clusters of tentacles; tentacle bulb ocellate.

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[11] Harriman Hydroids, 1901, P. 166.

Key to the species of *Bougainvillia* found in the Vancouver I. region.

A. Branches twining around the stem; gonophores in clusters .... *B. glorietta*

B. Branching loose ; gonophores single .... *B. mertensi*

Bougainvillia glorietta Torrey

Pl. IV, Fig. 9

Bougainvillia glorietta TORREY, Hydroids of San Diego, 1904, p. 7.
Bougainvillia glorietta FRASER, West Coast Hydroids, 1911, p. 23.

Trophosome.—Stem fascicled, branched, reaching a height of 20-30 cm.; branches with a tendency to twine around the stem; perisarc smooth or wavy, but without annulations; tentacles about 20 in number in an irregular whorl.

Gonosome.—Gonophores borne on the branches, in clusters of 3 or some times only 2. Medusæ with 4 pairs of tentacles.

Color.—Stem horn color, other parts lighter.

Distribution.—Near the entrance of Hammond Bay.

Torrey reports that the medusæ have 8 ocelli present before they are set free. The height given is also taken from his description; I have obtained none so large.

Bougainvillia mertensi Agassiz

Pl. IV, Fig. 10

Bougainvillia mertensi AGASSIZ, Cont. Nat. Hist. U.S., IV, 1862, p.344.
Bougainvillia mertensi A. AGASSIZ, N. A. Acalephæ, 1865, p, 152.
Bougainvillia mertensi FRASER, West Coast Hydroids, 1911, p. 24.

Trophosome.—Main stem thick, fascicled, reaching a height of 10 cm.; branching loose, larger branches fascicled; hydranths on rather short pedicels, far apart on the distal branches but not so much so on the proximal; perisarc smooth or wavy, slightly annulated on the pedicels.

Gonosome.—Gonophores borne singly on short branches, that in some cases are without hydranths. There may be more than one gonophore on a branch but they are not in pairs or clusters. The gonophore is provided with a short pedicel.

Color.—As in *B. glorietta.*

Distribution.—Gulf of Georgia (Agassiz); Nanoose Bay, Dodds Narrows, Gabriola Pass, Griffin Bay, Upright Channel, Friday Harbor.

Genus **PERIGONIMUS**

Trophosome.—Colony unbranched or slightly branched; hydranths clavate with conical or dome-shaped proboscis.

Gonosome.—Gonophores bearing medusæ that when liberated have 2-4 marginal tentacles arranged singly and no ocelli.

Perigonimus repens (Wright)

Pl. V, Fig. 11

Eudendrium pusillum Wright, Proc. Royal Phys. Soc. Edin., 1857, p. 231.

Atractylis repens Wright, Ibid., 1858, p. 450.

Perigonimus repens Allman, Ann. and Mag. Nat. Hist., 3rd ser., 8, 1864, p. 365.

Perigonimus repens Calkins, Some Hydroids of Puget Sound, 1899, p. 339.

Perigonimus repens Fraser, West Coast Hydroids, 1911, p. 24.

Trophosome.—Colonies small; stems unbranched or slightly and irregularly branched, arising from a reticulated hydrorhiza; perisarc well developed but apparently fitting very loosely over the cœnosarc. It is not expanded distally but is large enough that the hydranth may be retracted well within it. Tentacles about 10 in number standing out rather stiffly from the hydranth body.

Gonosome.—Gonophores borne on pedicels growing from the hydrorhiza or from the stem. In the latter case there may be one or more present on the same stem. Medusæ with two developed and two rudimentary tentacles at time of liberation.

Color.—White or grayish.

Distribution.—Townshend Harbor (Calkins); Departure Bay (Fraser); off Lasqueti I., off N. end of Gabriola I., Northumberland Channel.

The specimens obtained off Gabriola Island in 25 fathoms were much more robust than any others I have seen, but apart from the difference in size there was nothing to indicate that they belonged to a different species. The smaller specimens found in the other localities resemble those hitherto reported from this region.

Family **Eudendridæ**

Trophosome.—Colony branching; perisarc well developed; proboscis trumpet-shaped but with much freedom of movement; tentacles all filiform in a single whorl.

Gonosome.—Gonophores producing fixed sporosacs; male and female gonophores usually dissimilar, male gonophores in whorls, female in clusters.

Genus **EUDENDRIUM**

The only genus of the family *Eudendridæ.*

Key to the species of *Eudendrium* found in the Vancouver I. region.

A. Stems and branches strongly annulated.
  a. Stems coarse.
    1. Rings very distinct and close together....... *E. californicum*
    2. Rings less distinct and farther apart....... *E. vaginatum*
  b. Stems slender .... *E. insigne*

B. Stems and branches with but few annulations.
  a. Stems fascicled ....*E. rameum*
  b. Stem simple
    1. Hydranths entirely aborted on pedicels that bear gonophores.................................... *E. capillare*
    2. Hydranths not aborted.......................*E. tenellum*

Eudendrium californicum Torrey

Pl. V, Fig. 12

Eudendrium californicum TORREY, Hyd. of the Pacific Coast, 1902, p. 32.

Eudendrium californicum FRASER, West Coast Hydroids, 1911, p. 24.

Trophosome.—Stems stout, simple, in clusters from an encrusting plate-like hydrorhiza; branches stiff and short as compared with the length of the main stem, given off in all planes, each making a wide angle with the stem but distally turning in nearly the same direction as the stem; hydranths large with about 20 tentacles; perisarc on stem, branches and pedicels, very distinctly annulated with narrow annulations, extending over the body of the hydranth to the base of the tentacles.

Gonosome.—"Female gonophores monothalamic, crowded on the body of the hydranth immediately proximal to the tentacles, each gonophore with usually one ovum to which its orange color is due; male gonophores dithalamic in two or three whorls just proximal to the tentacles, a delicate pink with small green spadix, gonophores of both sexes invested with perisarc." (Torrey).

Color.—Perisarc dark brown or black; hydranths flesh pink; color of gonophores given above.

Distribution.—Port Renfrew, Ucluelet (Fraser); Northumberland Channel. Torrey gives the length of the stem as 140 mm. but I have found none longer than 90 mm. There are no gonophores on any of my specimens, consequently I have given the original description of Torrey's. He does not figure the male gonosome but a figure of the female is given and that has been made use of here.

Eudendrium capillare Alder

Pl. V, Fig. 13

Eudendrium capillare ALDER, Ann. and Mag. Nat. Hist. 2nd ser., 18, 1856, p. 355.

Eudendrium capillare HINCKS, British Hydroid Zoophytes, 1868, p. 84.

Eudendrium capillare FRASER, West Coast Hydroids, 1911, p. 24.

Trophosome.—Colony small, not more than 15 mm. in height, usually branched, annulations at the base of the branches and pedicels.

Gonosome.—Female gonophores borne on aborted hydranths which are supported by pedicels springing from branches or from the hydrorhiza. They form a very noticeable cluster. Male gonophores in whorls borne similarly to the female gonophores, each gonophore is usually 2-chambered.

Color.—Hydranths and male gonophores light green, female gonophores reddish orange.

Distribution.—San Juan Archipelago (Fraser); off Matia I., Friday Harbor.

Eudendrium insigne Hincks

Pl. V, Fig. 14

Eudendrium insigne HINCKS, Ann. and Mag. Nat. Hist., 3rd ser., 8, 1861, p. 159.

Eudendrium insigne HINCKS, Br. Hydroid Zoophytes, 1868, p. 86.

Trophosome.—Stolons form an irregular network from which the small colonies spring; stem simple, slender, with few branches given off irregularly. A branch is usually about the same size as the main stem, hence the branching appears dichotomous. Hydranths with 20-25 tentacles. There is a characteristic furrow passing horizontally around the body of the hydranth nearly half-way to the base of the tentacles from which the gonophores spring The stolon is not annulated but the stem, branches and pedicels are annulated throughout.

Gonosome.—Female gonophores globular on short stalks; male gonophores in a whorl, 2-chambered, each chamber oval.

Color.—Perisarc horn color, hydranth reddish-brown; female gonophores orange.

Distribution.—Clayuquot Sound, Pylades Channel.

I have not seen the male gonophores. The figure and the description of these are from Hincks.

Eudendrium rameum (Pallas)

Pl. VI, Fig. 15

Tubularia ramea PALLAS, Elench. Zooph., 1766, p. 83.

Eudendrium rameum TORREY, Hyd. of the Pacific Coast, 1902, p. 33.
Eudendrium rameum FRASER, West Coast Hydroids, 1911, p. 25.

Trophosome.—Stem large, fascicled, much and irregularly branched, large branches may also be fascicled, small branches give rise to the pedicels for the hydranths, these usually passing out from the distal side of the branches; hydranths with 24–25 tentacles; perisarc on main stem and on large branches smooth or at most wavy, small branches with a few rings or wrinkles at the base, pedicels annulated throughout.

Gonosome.—Female gonophores oval, borne in a cluster from the hydranth body below the base of the tentacles. Male gonophores similarly placed forming a whorl, 2–3 chambered.

Color.—Perisarc dark-brown, hydranths reddish, female gonophores yellow.

Distribution.—Swiftsure Shoal, off Matia I., off Waldron I., Friday Harbor.

I have not obtained any male gonophores. The description and the figure are from Jäderholm.

Eudendrium tenellum Allman

Pl. VI, Fig. 16

Eudendrium tenellum ALLMAN, Gulf Stream Hydroids, 1877, p. 8.
Eudendrium tenellum BONNEVIE, Neue Norvegische Hydroiden, 1898, p. 7.
Eudendrium tenellum JÄDERHOLM, Northern and Arctic Invert, 1909, p. 54.

Trophosome.—Colony very small, seldom reaching 1 cm. in height, slender, growing from a stolon which forms a loose network over worm tubes, etc.; stem unbranched or with one or more branches irregularly arranged and forming a wide angle with the stem; hydranth with about 20 tentacles; perisarc smooth for the most part, usually 2 or 3 annulations at the base of the stem and branches and often 2 or 3 together along the stem or branch, apparently at no definite distance from the base.

Gonosome.—Gonophores arranged around the base of the hydranth body, the female oval, the male two-chambered, the chambers nearly globular; the gonophores may spring from the stolon or from the branches.

Color.—Perisarc light horn color, hydranths flesh color.

Distribution.—Near Clarke Rock, north of Gabriola I., Northumberland Channel.

Eudendrium vaginatum Allman

Pl. VI, Fig. 17

Eudendrium vaginatum ALLMAN, Ann. and Mag. Nat. Hist., 3rd ser., 11, 1863, p. 10.
Eudendrium vaginatum NUTTING, Harriman Hydroids, 1901, p. 167.
Eudendrium vaginatum FRASER, West Coast Hydroids, 1911, p. 25.

Trophosome.—Colonies growing in small clusters may reach a height of 40 mm.; main stem much larger than the branches, the latter usually short and apparently loosely connected with the stem; tentacles fewer than 20; perisarc annulated throughout, the annulæ being farther apart and not so distinct as in *E. californicum*; the perisarc passes up on the body of the hydranth to the base of the tentacles, forming a cup-shaped portion that may be quite smooth or may be somewhat wrinkled.

Gonosome.—Male gonophores 2-chambered in a whorl about the base of the hydranth which is not aborted; "female gonophores in dense clusters around the bodies of hydranths that are usually devoid of tentacles. Each gonophore is borne on a pedicel which resembles that of a *Garveia* having a distinctly expanded collar a short distance below the hydranth." (Nutting).

Color.—Perisarc dark brown, hydranth vermilion.

Distribution.—Swiftsure Shoal.

No female gonophores are present in my material. The description and the figure are from Nutting.

Family **Hydractinidæ**

Trophosome.—Colony formed of distinct nutritive and generative zooids, growing from a common basal cœnosarc, which ordinarily is beset with spines. Other kinds of zooids may also be present. Hydranths with a row of filiform tentacles; proboscis conical or clavate.

Gonosome.—Gonophores in the form of fixed sporosacs on special generative zooids.

Genus **HYDRACTINIA**

This is the only genus of the family *Hydractinidæ.*

Key to the species of *Hydractinia* in the Vancouver I. region.

A. Spines jagged; sporosacs with several ova.........*H. aggregata*
B. Spines smooth; sporosacs each with one ovum.......*H. milleri*

Hydractinia aggregata Fraser

Pl. VI, Fig. 18

Hydractinia aggregata FRASER, West Coast Hydroids, 1911, p. 25.

Trophosome.—Nutritive zooids at many different stages of growth may be found in the same colony. They grow from a basal cœnosarc that is well supplied with jagged spines; these may be conical like those of *H. echinata*, they may be much blunter, more in the nature of columns, or these may be joined to form a ridge of some length. The zooids in a contracted state may be entirely below the tips of these spines. The number of tentacles increases during development until the number in the adult reaches 20–24.

Gonosome.—Sporosacs begin to develop on the generative zooids when they are very small, at which time they, i.e. the zooids, have a greater number of tentacles, 10–12, than when the sporosacs are fully developed, as then 3 or 4 seems to be the usual number. The generative as well as the nutritive zooids are provided with mouths. The sporosacs appear some distance below the tentacles, about one-fourth the distance from the tentacles to the base of the zooid. The ova are large and numerous. The male sporosacs are oval, not nearly so large as the female.

Color.—Pink, female gonophores orange.

Distribution.—Departure Bay, San Juan Archipelago (Fraser); common on gastropod shells all along the Strait of Georgia near Departure Bay as indicated by the fact that it has been dredged north of Nanoose Bay, in Nanoose Bay, at the entrance of Hammond Bay, off Clarke Rock, off West Rocks, in various parts of Departure Bay and at its entrance, east of Protection I., Northumberland Channel, Dodds Narrows, Pylades Channel, Gabriola Pass; found also at Friday Harbor.

In the colonies of this species the nutritive zooids are arranged around the outside, especially around the lip of the shell on which they rest, while the generative zooids are aggregated towards the centre in a dense mass. They are so close together and the mature sporosacs are so large that it is almost impossible to see down to the basal cœnosarc at any place. When the generative zooids are young they fit down between the large spines and ridges so well that they are very well protected. I have not seen any special sensory or protective zooids present in any of the colonies.

Hydractinia milleri Torrey

Pl. VII, Fig. 19

Hydractinia milleri TORREY, Hyd. of the Pacific Coast, 1902, p. 34.
Hydractinia milleri FRASER, West Coast Hydroids, 1911, p. 27.

Trophosome.—Colony growing from a basal cœnosarc, which is provided with long smooth spines; nutritive zooids robust when mature

reaching a height of about 5 mm. The clavate proboscis is capable of very great extension, but it may be contracted until it is little more than a knob. There are 12-20 tentacles in an irregular whorl which under certain conditions of contraction, shows an arrangement into sets of four.

Gonosome.—Generative zooids shorter and more slender than the nutritive; tentacles fewer in number but never entirely lacking; sporosacs borne very low, about midway between the tentacles and the base of the zooid. They are not so numerous as in *H. aggregata*, 4 being the greatest number noticed on one zooid. Female sporosacs are small with usually but one ovum; male sporosacs larger.

Other zooids.—"Spiral zooids at the edge of the colony, about as long as the sterile hydranths, but much more slender, the whole structure resembling a very long tentacle." (Torrey).

Color.—Pink, female sporosacs light orange.

Distribution.—Port Renfrew (Fraser).

This species grows in masses on the rocks at low tide where it is washed by the breakers. I have not seen any of the spiral zooids that Torrey has described and as he made no drawings of them I cannot illustrate them.

Family **Tubularidæ**

Trophosome.—Colony unbranched or irregular branched; hydranths with a proximal and a distal set of filiform tentacles.

Gonosome.—Gonophores borne on the hydranth between the two sets of tentacles give rise to actinulæ.

Genus **TUBULARIA**

Trophosome.—Colony unbranched or irregularly branched; hydranths large; proximal set of tentacles longer than the distal set.

Gonosome.—Gonophores in clusters, attached by means of stalked peduncles to the body of the hydranth just distal to the proximal tentacles; female gonophores producing actinulæ.

Key to the species of *Tubularia* in the Vancouver I. region.

A. Perisarc extensively annulated . . . . *T. larynx*
B. Perisarc not extensively annulated
  a. Colony irregularly branched . . . . *T. crocea*
  b. Colony unbranched
    1. Distal tentacles less numerous than proximal . . *T. harrimani*
    2. Distal tentacles more numerous than proximal . . *T. indivisa*

Tubularia crocea (Agassiz)

Pl. VIII, Fig. 20

Parypha crocea AGASSIZ, Cont. Nat. Hist. U.S., IV, 1862, p. 249.
Tubularia crocea FRASER, West Coast Hydroids, 1911, p. 28.

Trophosome.—Colony growing in immense tufts which make a tangled mass below but separated into long pedicels which reach out of the mass above; branching very irregular; stems slightly and irregularly annulated, somewhat swollen just below the hydranth; proximal and distal tentacles nearly equal in number, 20-24.

Gonosome.—Gonophores growing in rather long racemes, which, however, seldom hang below the tentacles; each is provided with 4 short tentacular processes but these may be very short or almost suppressed.

Color.—Hydranths and gonophores rose color with the spadix brighter; stems almost white in the distal portion but yellower in the proximal portion.

Distribution.—Port Simpson (Fraser); Gabriola Pass, Porlier Pass, Friday Harbor.

I have not found this species growing in such masses in this region as it does at Woods Hole, South Harpswell and other places on the New England coast but the individuals are just as large and the proximal mass is just as much tangled. The specimens from Friday Harbor were obtained the last of July and they were then in good condition with the large clusters of gonophores present. At this time of the year, much before this time in fact, the heads are all gone at Woods Hole but at South Harpswell they are as fresh as ever, as recorded in a former paper.[12]

The temperature of the water and the lack of contamination at the Friday Harbor localities, corresponds more nearly with conditions at South Harpswell and it may be that these have something to do with the continued active period.

Tubularia harrimani Nutting

Pl. VIII, Fig. 21

Tubularia harrimani NUTTING, Harriman Hydroids, 1901, p. 168.
Tubularia harrimani FRASER, West Coast Hydroids, 1911, p. 28.

Trophosome.—Stem usually unbranched, reaching a height of 40-50 mm.; there are few annulations but these are usually very distinct; stem slender at the base, rapidly increasing in size proximally and more slowly distally towards the hydranth; proximal tentacles

[12] New England Hydroids, 1912, p. 42.

much more numerous than the distal, there being 40-50 proximal and only about 20 distal.

Gonosome.—Gonophores borne on several long, densely-crowded racemes attached by slender peduncles; each gonophore is provided with 3 or 4 short tentacles that may be almost as long as the gonophore itself.

Color.—Hydranths and gonophores light pink with the spadix darker, stems whitish.

Distribution.—Port Renfrew (Fraser); off Matia I., off Brown I., Friday Harbor.

In the specimens obtained in no instance were the gonophore racemes so pendulous as shown in Nutting's figure. It may be that they were not mature. Nutting says nothing about this in his description and perhaps his drawing shows only a special instance. Since he has shown it so, however, I have thought it advisable to reproduce his drawing instead of giving a figure of one of my own specimens. Taken with these remarks it will not be misleading in any case.

Tubularia indivisa Linnæus

Pl. IX, Fig. 22

Tubularia indivisa Linnæus, Syst. Nat., 1767, p. 1301.
Tubularia indivisa Hincks, Br. Hydroid Zoophytes, 1868, p. 115.
Tubularia indivisa Fraser, West Coast Hydroids, 1911, p. 28.

Trophosome.—Stems seldom branched, growing in clusters; much the largest species of these here reported (Hincks says it may reach a height of 12 inches) and the perisarc is heavier than in any of the other species; the stem may be twisted at the base but there are no distinct annulations; the proximal tentacles are long, slender and numerous, up to 40, but the distal are even more numerous.

Gonosome.—Gonophores in racemes but not such long ones as in *T. harrimani;* gonophores devoid of tentacular processes.

Color.—Stem horn color; hydranths and spadices of gonophores deep red; remainder of gonophore much lighter; tentacles almost white.

Distribution.—Alert Bay, off Waldron I., off Brown I.

The specimens from Alert Bay were young and small, those from Friday Harbor were larger. The largest specimen was not complete but the part obtained was 10 cm. long. Specimens are too large to draw with the usual magnification.

Tubularia larynx Ellis and Solander

Pl. IX, Fig. 23

Tubularia larynx Ellis and Solander, Nat. Hist. Zooph., 1786, p. 31.

Tubularia larynx CALKINS, Some Hydroids of Puget Sound, 1899, p. 335.

Tubularia larynx FRASER, West Coast Hydroids, 1911, p. 28.

Trophosome.—Colony consisting of stems much branched and somewhat tangled at the base, usually extensively annulated but the nature of the annulations may vary. They may be deeply cut as in some of the *Eudendridæ*, but more commonly the furrows as well as the ridges are rounded to give the surface a wavy appearance. Tentacles approximately the same number in the proximal and distal sets, about 20.

Gonosome.—Gonophores arranged in clusters that are denser and more compact than in other species described. The tentacular processes are not extensively developed.

Color.—Perisarc light horn color, hydranths and gonophores pink or scarlet.

Distribution.—Port Townshend (Calkins); Nanoose Bay, Gabriola Pass, off Pt. Richardson and at other points near Friday Harbor, Samish Bay.

Calkins in reporting this species from Port Townshend Harbor, mentions several points in which his specimens differ from those described by Hincks. Those I have found more nearly agree with Hincks'. I found few of them singly and in no case did I find any in which the proximal tentacles were twice as many as the distal or nearly so; they always very nearly agreed. I found some specimens off Brown Island in which the hydranth body was well developed, as shown in Calkins' figure and the adjacent proximal tentacles were some distance apart at their bases but even in these there were as many oral as aboral tentacles. The gonophore clusters were just starting to develop. Some of the oral tentacles when contracted appeared to be knobbed at the end so that the hydranth had the appearance of *Acharadria larynx* Wright as figured by Hincks, the gonophore clusters had a resemblance also. It may be that these specimens belonged to that species but it seems hardly probable as they were found along with the typical specimens of *Tubularia larynx*.

Family **Hybocodonidæ**

Trophosome.—"Colony unbranched. Stem with a distinct chitinous perisarc, and rooted by a true hydrorhiza. Hydranths large, with a proximal and distal set of filiform tentacles" (Nutting).

Gonosome.—"Gonophores producing free medusæ" (Nutting).

Genus **HYBOCODON**

Trophosome.—"Stem with distinct deeply annulated expansion

just below hydranth. Hydranth with a proximal whorl and two distinct but closely approximated distal whorls of filiform tentacles" (Nutting).

Gonosome.—"Gonophores attached directly to the hydranth body without the intervention of peduncles and developing into free medusæ, each of which has a single large tentacle bearing succeeding generations of medusæ. The medusæ are deeply campanulate with four radial canals and short proboscis" (Nutting).

Hybocodon prolifer Agassiz

Pl. X, Fig. 24

Hybocodon prolifer Agassiz, Cont. Nat. Hist. U.S., IV, 1862, p. 243.
Hybocodon prolifer Nutting, Hydroids of Woods Hole, 1901, p. 341.

Trophosome.—"Hydrocaulus unbranched, longitudinally striped owing to the cœnosarcal canals showing through; perisarc suddenly enlarging near the hydranth, where a number of collar-like swollen rings appear, the uppermost being the largest. Hydranth much like that of *Tubularia* but with two distinctly separated whorls of tentacles around the proboscis, each whorl being composed of about 16 tentacles, the lower being twice as long as the upper" (Nutting).

Gonosome.—"Gonophores adnate to the hydranth body just above the basal whorl of tentacles, producing free medusæ with four radial canals and 5 superficial meridional orange-colored bands when fully mature. The single tentacle is greatly enlarged and near its base a number of medusæ in various stages of development are attached and these again in the same manner may bear other groups of medusæ" (Nutting).

Color.—"The pigmentation of both hydranth and medusa is orange red" (Nutting).

Distribution.—Medusa found at the Station float, Departure Bay, Feb. 17, 1913.

No Hybocodon hydroid has been found on this coast but since the medusa has been, it seems well to include it here. I can detect no difference between this medusa and *Hybocodon prolifer* and since this one was found, Bigelow's paper has appeared in which he reports 50 excellent specimens from Dutch Harbor.[13] Some descriptions of that species state that only one tentacle is present but Mayer refers to the fact that as many as 3 may be present,[14] while Bigelow says "Most of the specimens have three large tentacles, with one or two medusa buds; but some have only one tentacle, some two and several

[13] Pacific Medusæ and Siphonophoræ, Proc. U. S. Nat. Mus., 1913, p. 6.

[14] Medusæ of the World, vol. I, 1910, p. 39.

four. The medusa buds vary in number from one (in specimens with three or four tentacles) to three or four; and they are in every stage of development from mere knobs to medusæ which are themselves in the act of budding."[15]

In the Departure Bay specimen there were three long distinct tentacles and some of the secondary medusæ had tentacles of considerable length as well. It may be that this is the same species that Fewkes has described as *Steenstrupia occidentalis*,[16] or as Hartlaub has later suggested *Hybocodon occidentalis*[17] but I cannot see where the difference comes in between it and *Hybocodon prolifer*. The dimensions agree with those given by Mayer and the color of the manubrium, "orange-red," describes exactly the color in the specimen.

Agassiz's description is too prolix to use in this connection, hence I have taken Nutting's *in toto*, although, as already mentioned, I find a cluster of three tentacles in the medusa instead of the one tentacle that he describes. The drawing of the hydroid is taken from Agassiz.

Sub-order **CALYPTOBLASTEA**

Hydroids with hydranths protected with hydrothecæ and gonophores protected by gonangia or similar structures.

Family **Campanularidæ**

Trophosome.—Hydrothecæ campanulate, never sessile, never adnate to or immersed in the stem or branches, diaphragm always present; hydranth with trumpet-shaped proboscis.

Gonosome.—Gonophores producing sporosacs or free medusæ; the medusæ when produced usually have otocysts and have the ovaries along the course of the radial canals.

Key to the genera of Campanularidæ found in the Vancouver I. region.

A. Gonophores producing sporosacs in which the planulæ are developed.
   a. Reproduction by sporosacs which remain within the gonangium during the development of the planulæ . . .*Campanularia*
   b. Reproduction by sporosacs which are extruded into a sac at the summit of the gonangium, in which sac the planulæ are developed . . . . *Gonothyræa*

B. Gonophores producing medusoids without mouth or digestive cavity . . . . *Eucopella*

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[15] As above in 13.

[16] Bull. Essex Inst. vol. 21, no. 7, 1889, p. 107.

[17] Zool. Jahrb. Suppl. 6, 1905, p. 545.

C. Gonophores producing free medusæ
   a. Medusæ globular, with four tentacles at time of liberation .... *Clytia*
   b. Medusæ flatter, with 16 or more tentacles at time of liberation .... *Obelia*

There are few distinguishing differences in the trophosomes of these genera.

Genus **CAMPANULARIA**

Trophosome.—As in the family.

Gonosome.—Gonophores producing sporosacs from which planulæ develop within the gonangia.

Key to the species of *Campanularia* found in the Vancouver I. region.

A. Stem fascicled
   a. Hydranth pedicels in a whorl................ *C. verticillata*
   b. Hydranth pedicels given off singly .... *C. gelatinosa*
B. Stem branched but not fascicled.................. *C. exigua*
C. Stem unbranched or slightly branched
   a. Hydrotheca margin entire
      1. Hydrothecæ very large..................... *C. regia*
      2. Hydrothecæ of smaller size with thin walls.... *C. integra*
      3. Hydrothecæ with thick walls, margin sometimes wavy .... *C. everta*
   b. Hydrothecal margin toothed
      1. Hydrothecæ with vertical lines
         i. Lines very distinct throughout the whole length of the hydrotheca.............. *C. grœnlandica*
         ii. Lines distinct towards margin only... *C. speciosa*
      2. Hydrothecæ without vertical lines
         i. Each tooth in the margin with two cusps........ .... *C. longitheca*
         ii. Teeth 5 or 6 in number............ *C. raridentata*
         iii. Teeth blunt about 10 in munber...... *C. volubilis*
         iv. Teeth blunt 12-18 in number........ *C. urceolata*
         v. Teeth deep, acute; hydrotheca tapering from margin to base................. *C. denticulata*
         vi. Teeth shallow, acute, hydrotheca suddenly narrowing at base................. *C. fusiformis*

Campanularia denticulata Clark

Pl. X, Fig. 25

Campanularia denticulata Clark, Alaskan Hydroids, 1876, p. 213.
Campanularia denticulata Fraser, West Coast Hydroids, 1911, p. 29.

Trophosome.—Stems usually unbranched but occasionally one branch also giving rise to a hydrotheca appears, growing from a stolon which is not annulated to any extent. The stem or pedicel of the hydranth varies much in length and the amount of annulation. Usually there are several annulations at the base and fewer at the distal end below the hydrotheca. Hydrotheca deeply campanulate, tapering very gradually from margin to base. Teeth deep, acute, about 15 in number.

Gonosome.—There is no gonosome in any of my specimens but I have seen it in Prof. Nutting's specimens and I believe he has described it in his monograph of the Campanularidæ, not yet published. It is sufficient to say here, that there is no doubt as to its belonging to the genus *Campanularia.*

Distribution.—Departure Bay, San Juan Archipelago (Fraser); near Round I. in Dodds Narrows, off Matia I.

In connection with this species in my West Coast paper, I referred to the resemblance between it and the unbranched specimens of *Clytia edwardsi* (Nutting). At that time I was not convinced that there were two distinct species. Later I saw the gonosome in some of Prof. Nutting's specimens and as it was distinctly campanularian, it cleared up any doubt there was in the matter. There is much resemblance between the hydrothecæ of the two but that of *C. denticulata* is usually much smaller.

Campanularia everta Clark

Pl. X, Fig. 26

Campanularia everta Clark, Hyd. of the Pacific Coast, 1876, p. 253.
Campanularia everta Torrey, Hyd. of the Pacific Coast, 1902, p. 51.
Eucopella everta Fraser, West Coast Hydroids, 1911, p. 37.

Trophosome.—Stems unbranched, arising from a reticulated stolon; pedicels irregularly annulated or wavy throughout with a distinct double annulation below the hydrotheca, hydrotheca very variable; the wall may be quite thick or comparatively thin but even at the thinnest it is thicker than that of the majority of the campanularians; the margin is sometimes strongly everted and at other times not everted in the least; the margin may be perfectly even, slightly crenulated or distinctly wavy.

Gonosome.—Gonangia borne on the stolon by means of short pedicels that may have one or two annulations; the male gonangia are smaller than the female but are of the same shape, broadly oval in one plane and more oblong in the other; surface smooth or with large shallow corrugations; distal end rather truncate with the opening

occupying but a small portion; in the female each sporosac becomes extended as an acrocyst.

Distribution.—Port Renfrew, Departure Bay (Fraser).

Campanularia exigua (Sars)

Pl. X, Fig. 27

Laomedea exigua Sars, Middelhavet's Littoral Fauna, 1857, p. 50.
Campanularia exigua Hincks, Br. Hydroid Zoophytes, 1868, p. 172.
Campanularia exigua Calkins, Some Hydroids from Puget Sound, 1899, p. 353.
Campanularia exigua Fraser, West Coast Hydroids, 1911, p. 30.

Trophosome.—"Stem very delicate, slightly flexuous, giving off at each bend simple pedicels, ringed at the base and upper extremity (the intermediate space being smooth) which support the pedicels; height about 1/4 inch; hydrothecæ very small, regularly funnel-shaped, with an even rim" (Hincks).

Gonosome.—"Gonothecæ axillary, elongate, smooth, somewhat fusiform" (Hincks).

Distribution.—Port Townshend (Calkins).

Calkins reported this species from Port Townshend but was in doubt concerning it. I reported it from Ucluelet but I do not think now that the specimens were of that species. I have quoted Hincks as Calkins did and have also made use of his figures.

Campanularia fusiformis Clark

Pl. X, Fig. 28

Campanularia fusiformis Clark, Hyd. of the Pacific Coast, 1876, p. 254.
Campanularia fusiformis Fraser, West Coast Hydroids, 1911, p. 30.

Trophosome.—"Hydrocaulus simple, creeping, bearing the pedicels at irregular intervals; pedicels of variable length, usually two or three times the length of the hydrotheca, never more than six times their length, with a more or less wavy outline. Hydrothecæ small, deeply campanulate, tapering at the base, rim ornamented with about 12 stout, shallow acute teeth, a single distinct annulation at the base" (Clark).

Gonosome.—"Gonothecæ small, fusiform, constricted at both ends, sessile; aperture small, terminal" (Clark).

Distribution.—Vancouver Island (Clark).

I have not found this species but as Clark has reported it from Vancouver Island, I have included it, using his description and figures.

Campanularia gelatinosa (Pallas)

Pl. XI, Fig. 29

Sertularia gelatinosa PALLAS, Elench, Zooph., 1766, p. 116.
Laomedea pacifica A. AGASSIZ, Ill. Cat., 1865, p. 194.
Obelia gelatinosa HINCKS, Br. Hydroid Zoophytes, 1868, p. 151.
Obelaria gelatinosa HARTLAUB, Die Hydromedusen Helgolands, 1897, p. 488.
Obelia gelatinosa CALKINS, Some Hydroids of Puget Sound, 1899, p. 357.
Campanularia pacifica TORREY, Hyd. from the Pacific Coast, 1902, p. 53.
Campanularia pacifica FRASER, West Coast Hydroids, 1911, p. 32.
Obelia gelatinosa FRASER, West Coast Hydroids, 1911, p. 39.

Trophosome.—Stem fascicled, growing in clusters, reaching a height of 200–250 mm.; larger branches are also fascicled; in the fascicled portions the perisarc is thickened and dark in color, but in the smaller branches and their ramifications it is whitish transparent. As the small branches divide somewhat dichotomously, a large number of hydranth pedicels appear close together and these in their whiteness give the gelatinous appearance when in the water, to which evidently the specific name is due. The branches have usually 3–5 annulations at the base and the larger branches from which they spring have a similar number above their points of origin. The hydranth pedicels are slender, varying much in length; the shorter ones are annulated throughout but the longer ones may have a smooth portion towards the centre. The hydrothecæ are deeply campanulate, tapering quite gradually from margin to base; margin provided with about 10 teeth, each provided with two cusps.

Gonosome.—Gonangia elongated oval with distinct neck and tapering base; pedicel short, annulated.

Distribution.—Gulf of Georgia (A. Agassiz); Discovery Bay, Wash. (Calkins); San Juan Archipelago (Fraser); Nanoose Bay, near Clarke Rock, Northumberland Channel, Dodds Narrows, Whaleboat Passage, off Matia I., Friday Harbor, off Brown I., Upright Channel, off O'Neale I., off Waldron I., San Juan Channel, Pt. Townshend.

Hincks in describing this species, says that it gives rise to free medusæ. As he usually was so very reliable, this statement has been copied by many since his time, who have found only the trophosome. Apparently the error was not noticed until Hartlaub, working on Heligoland hydroids, found abundant material for the study of the species. His investigation apparently established beyond doubt

that in the species no free medusæ were produced. He goes further than this and makes a new genus for the species because he found that the egg-cells were developed outside the sporosacs, in the stem or stolon and only after the sporosacs became larger did they wander in. This is his chief reason for creating the new genus *Obelaria*, although the nature of the growth of the fascicled stem appears to have some weight with him also. As far as this latter is concerned, we have a great variety of simple and fascicled stems in many other genera and there seems no particular reason why they should not occur here. As far as the development of the egg-cells is concerned, I have seen nothing to indicate that the development of the egg-cell, as to whether it takes place external to or within the sporosac, has been worked out in very many of the species that we now place in the genus *Campanularia*. Unless the whole genus is revised on that basis, it is quite probable that a greater anomaly will exist by singling this species out to make a new genus than if it were allowed to remain with the genus *Campanularia*, which will include all the campanularian species in which the planulæ are produced from ova in the sporosacs while these remain in the gonangia.

Agassiz' description of *Laomedea pacifica* is too meagre to base any definite conclusion upon. Torrey's description of what is probably the same *Laomedea pacifica* is quite complete. As he found sporosacs in the gonangium he evidently concluded that it could not be the same species that Hincks described as *Obelia gelatinosa* and hence he named it *Campanularia pacifica*. In my former paper I stated the same conclusion. Calkins found the species at Discovery Bay but as he did not find the gonosome, he did not have any compunction against naming it *Obelia gelatinosa*. I am now fully convinced that all the material collected along the coast and reported as either *Obelia gelatinosa* or *Campanularia pacifica* belongs to the one species which I have here described as *Campanularia gelatinosa*.

The specimens reported from San Juan Archipelago as *Obelia corona* were probably young specimens of *Campanularia gelatinosa*.

Campanularia grœnlandica Levinsen

Pl. XI, Fig. 30

Campanularia grœnlandica Levinsen, Meduser, Ctenophorer og Hydroider, 1893, p. 26.

Campanularia lineata Nutting, Hyd. from Alaska and Puget Sound, 1899, p. 744.

Campanularia grœnlandica Fraser, West Coast Hydroids, 1911, p. 31.

Trophosome.—Stem unbranched forming the hydranth pedicel,

annulated or wavy throughout but the stolon is not annulated; hydrothecæ large, somewhat urceolate although at times the sides are almost straight, the base being hemispherical; the 10–12 teeth are quite deep, rounded or squared off at the tip; the wall of the hydrotheca is somewhat ribbed, the line so formed showing quite distinctly, running from the spaces between the teeth, the full length of the hydrotheca.

Gonosome.—Gonangia large, bottle-shaped with a long neck, attached to the stolon by a very short pedicel; surface smooth; ova very few, large.

Distribution.—Puget Sound (Nutting); Port Renfrew (Fraser); off Cape Edenshaw, Swiftsure Shoal, off Lasqueti I., Northumberland Channel, off Matia I., off Sucia Is., off O'Neale I., Friday Harbor.

Campanularia integra MacGillivray

Pl. XI, Fig. 31

Campanularia integra MacGillivray, Ann. and Mag. Nat. Hist., 2nd ser., 9, 1842, p. 465.

Campanularia integra Fraser, West Coast Hydroids, 1911, p. 31.

Trophosome.—Stems unbranched forming the pedicels for the hydranths, arising from a stoloniferous network; the pedicels are long and slender, varying much in the amount of the annulation; there is always one clear cut annulation, accompanied by two or three others less deep at the base of the hydrotheca; hydrotheca rather small, tapering gradually from margin to base; margin entire.

Gonosome.—Gonangium large, deeply corrugated, each corrugation with a distinct keel, attached to the stolon by a short annulated pedical.

Distribution.—Pt. Wilson, Pt. Townshend and Bremerton, Wash. (Calkins); San Juan Archipelago (Fraser); off Round I. in Dodds Narrows, Gabriola Pass, off Waldron I.

? **Campanularia longitheca** new species*

Pl. XI, Fig. 32

Trophosome.—Stems unbranched serving as the pedicels for the hydranths; pedicels long and slender, with several annulations at

*Note.—Since the manuscript of this paper was sent to the press, the gonosome of this species has been obtained and in consequence it is necessary to place it, not in the genus *Campanularia*, but in the genus *Clytia*, as *Clytia longitheca*.

The gonangium is attached to the stolon by a short pedicel with three annulations. It is rather long and slender, 1.25 mm. in length and .3 mm. in greatest width. The base is narrow and from this the gonangium gradually increases in size for the proximal third of the length, after which it is practically uniform. The distal end is sharply truncate, with the opening occupying less than one-third of the surface. The walls are smooth. In the specimens obtained there were five medusæ in each gonangium.

The specimens were dredged in 15 fathoms at the entrance to Nanoose Bay.

the base of the hydrothecæ, fewer at the base of the pedicels and in some cases 3–5 towards the centre; hydrothecæ very long, tapering very gradually from margin to base; the 9–10 teeth are deeply cut and each is provided with two distinct cusps.

Gonosome.—Unknown.

Distribution.—Nanoose Bay, Departure Bay, east of Protection I., near Round I. in Dodds Narrows, Whaleboat Passage.

The margin of the hydrotheca in this species resembles that of *C. gelatinosa* but the hydrothecæ are much longer, absolutely and relatively to the width than in that species. In its simple unbranched stem it goes to the other extreme to the fascicled and much branched stem of *C. gelatinosa.* The hydrotheca also resembles that of *Campanularia neglecta* Alder, but the cusps on the teeth are much more distinct on account of the incision between the cusps being deeper. The cusps are blunter than in *C. neglecta.* *Clytia longicyatha* (Allman) has a longer hydrotheca but the ratio to its greatest width is not so great as for this species.

As the gonosome has not been found the species can be put in the genus *Campanularia* provisionally.

? **Campanularia raridentata** Alder

Pl. XI, Fig. 33

Campanularia raridentata Alder, Ann. and Mag. Nat. Hist., 3rd ser., 9, 1862, p. 315.

Campanularia raridentata Fraser, West Coast Hydroids, 1911, p. 32.

Trophosome.—Stems unbranched serving for the pedicels of the hydranths, arising from a stolon which at this point has a distinct elevation, somewhat bulbous in appearance; pedicel annulated at the base and below the hydrotheca and sometimes more or less throughout; hydrotheca long and narrow, tapering but slightly from margin to base; teeth usually 5 in number, deep and rounded at the tip.

Gonosome.—Unknown,

Distribution.—Departure Bay, Queen Charlotte Is. (Fraser); Rose Spit, Departure Bay, Northumberland Channel, Friday Harbor.

As the gonosome is still unknown, the species must remain in this genus provisionally.

Campanularia regia Nutting

Pl. XII, Fig. 34

Campanularia regia Nutting, Harriman Hydroids, 1901, p. 172.

Campanularia regia Fraser, West Coast Hydroids, 1911, p. 32.

Trophosome.—Stems unbranched serving as pedicels, arising from a stolon; pedicels often shorter than the hydrothecæ, without annula-

tions or with one or two; hydrothecæ very large reaching a length of 3·5 mm. and a breadth of 1·25 mm., almost tubular in some cases but more urceolate in others; margin slightly everted and slightly sinuous, the sinuosities being wide but very shallow; reduplication of the margin often takes place; hydranth with 18–20 tentacles.

Gonosome.—(Not previously described). Gonangium large but not so, relatively to the hydrotheca; it is about 2/3 the length and 2/3 the diameter of the hydrotheca; it is deeply corrugated, each corrugation being provided with a keel. It resembles the gonangium of *C. integra* but is much larger.

Distribution.—Off Matia I., off Sucia I., very plentiful in some Friday Harbor material.

Campanularia speciosa Clark

Pl. XII, Fig. 35

Campanularia speciosa CLARK, Alaskan Hydroids, 1876, p. 171.

Campanularia speciosa LEVINSEN, Meduser, Ctenophorer og Hydroider, 1893, p. 167.

Campanularia speciosa FRASER, West Coast Hydroids, 1911, p. 33.

Trophosome.—Stems unbranched serving as pedicels, arising from an annulated stolon; the pedicels are also annulated throughout, they are short as compared with the length of the hydrothecæ and may be shorter than they are; hydrothecæ large although not nearly so large as those of *C. regia*, reaching a height of 2 mm., urceolate; margin rather undulated than toothed as the tooth is low and rounded; teeth 10–12 in number; from the teeth lines run down the wall of the hydrotheca for some distance but they cannot be traced more than one-third of the distance to the base.

Gonosome.—Gonangium shaped like an inverted cone, except that the sides are somewhat curved; the height and greatest width are nearly equal; the pedicel is very short.

Distribution.—Friday Harbor (Fraser); off Massett, Gabriola Pass, off Matia I.

I have already called attention[18] to the great resemblance between the trophosome of this species and that of *C. magnifica* Fraser, although the gonosome is very different in the two species. Levinsen gave a correct description and figure of the gonosome of this species but since the paper referring to this matter was written and before it was published, Broch, having found *C. magnifica* supposed it to be *C. speciosa* and stated that Levinsen's gonangium was not fully de-

[18] Hydroids from Nova Scotia, 1913, p. 164.

veloped.[19] To bear this out he gives a figure showing the hydrotheca and the gonangium of *C. magnifica*.

The figure given here is the one previously used, drawn from one of Clark's specimens from Shumagin Is. I have not found any gonangia in my own material and the specimens obtained are not so large as the Alaska specimens.

Campanularia urceolata Clark

Pl. XII, Fig. 36

Campanularia urceolata Clark, Alaskan Hydroids, 1876, p. 215
Campanularia urceolata Torrey, Hyd. of Pacific Coast, 1902, p. 54.
Campanularia urceolata Fraser, West Coast Hydroids, 1911, p. 33.

Trophosome.—Stems unbranched serving as pedicels, arising from a stolon that is usually smooth when attached to a surface (usually of other hydroids) but strongly annulated when it is free; pedicels varying much in length, usually annulated or wavy throughout; hydrothecæ very variable in size, shape and nature of margin; they may be tubular, urceolate, or turgid towards the base; the margin has 12–18 teeth, usually shallow and blunt; reduplication of the margin often takes place. These variations account for the various synonyms, *turgida*, *cylindrica*, and *reduplicata*, being used.

Gonosome.—Female gonangia bottle-shaped with long neck; surface wavy or slightly corrugated; attached to stolon with very short annulated pedicels; there appears to be but one sporosac present containing 7 or 8 ova. The male gonangia are short, not much longer than wide and without the bottle neck; the sinuosities are more deeply cut and that gives the gonangium an irregular shape.

Distribution.—Bare Island (Hartlaub); Queen Charlotte Is., Dodds Narrows, San Juan Archipelago (Fraser); found in almost every locality in which dredging has been done from Queen Charlotte Is. to Puget Sound, both east and west coasts of the Island. It grows on a great number of other hydroids and may be also found on worm tubes, etc.

Torrey has given several figures to show the amount of variation in the shape of the hydrotheca in this species.

Campanularia verticillata (Linnæus)

Pl. XIII, Fig. 37

Sertularia verticillata Linnæus, Syst. Nat., 1758, p. 811.
Campanularia circula Clark, Alaskan Hydroids, 1876, p. 213.

[19] Coelentérés du Fond, 1912, p. 18.

Campanularia fascia TORREY, Hyd. of the Pacific Coast, 1902, p. 52.
Campanularia verticillata FRASER, 1911, p. 34.

Trophosome.—Main stem fascicled throughout, ending like a stump; main branches also fascicled; hydranths arranged in irregular whorls, with rather long pedicels, annulated or wavy throughout; hydrothecæ rather large, broad for their length, slightly more expanded towards the margin; margin with 12–14 low blunt teeth.

Gonosome.—Gonangia somewhat fusiform except that the distal end is prolonged into a neck, sessile on the stem; often occurring in groups around the stem, although not forming a whorl; ova large.

Distribution.—Puget Sound (Nutting); Queen Charlotte Is., Dodds Narrows, San Juan Archipelago (Fraser); widely distributed, found at Rose Spit, Claninnick, Clayuquot Sd., off Lasqueti I., off Clarke Rock, off West Rocks, off Snake I., Northumberland Channel, Dodds Narrows, Gabriola Pass, Gabriola Reefs, off Matia I., off Waldron I., off Sucia Is., Griffin Bay, Upright Channel, Friday Harbor, Deer Harbor, Pt. Townshend.

Campanularia volubilis (Linnæus)

Pl. XIII, Fig. 38

Sertularia volubilis LINNÆUS, Syst. Nat., 1767, p. 1311.
Campanularia volubilis FRASER, West Coast Hydroids, 1911, p. 34.

Trophosome.—Stems unbranched serving as pedicels, arising from a stolon that may be plain or twisted; pedicels slender, spirally twisted or annulated; hydrothecæ tubular, narrow and deep; margin with about 10 rounded teeth which may be very shallow so that the margin appears merely sinuous.

Gonosome.—Gonangia flask-shaped, with long narrow neck, borne on the stolon by means of short annulated pedicels.

Distribution.—Bare Island (Hartlaub); Banks I., Ucluelet, San Juan Archipelago (Fraser); Northumberland Channel, Dodds Narrows.

Genus **CLYTIA**

Trophosome.—Stem unbranched or irregularly branched.

Gonosome.—Gonophores producing free medusæ, somewhat spherical, with four tentacles at time of liberation.

Key to the species of *Clytia* in the Vancouver I. region.

A. Stem usually much branched
   a. Gonangium smooth .... *C. attenuata*
   b. Gonangium corrugated .... *C. edwardsi*
B. Stem unbranched or with but one or two branches
   a. Hydrotheca ribbed .... *C. kincaidi*

b. Hydrotheca smooth
  1. Hydrotheca small with 7 teeth . . . . *C. inconspicua*
  2. Hydrotheca with 10-12 teeth
    i. Gonangium smooth . . . . *C. cylindrica*
    ii. Gonangium corrugated . . . . *C. johnstoni*

Clytia attenuata (Calkins)

Pl. XIII, Fig. 39

Campanularia attenuata CALKINS, Some Hydroids of Puget Sound, 1899, p. 350.

Clytia attenuata FRASER, West Coast Hydroids, 1911, p. 34.

Trophosome.—"Stem flexuous, very long, branches given off at short intervals from a creeping stolon, 10-16 rings given off at base and above point of branching. The parent stem is not ringed above the branches. With from 2-7 or 8 well marked rings below hydrotheca, but often reduced in diameter as it approaches the base of the hydrotheca. The branches are given off at long intervals and are bent directly upwards, parallel with the parent stem. The hydrothecæ are large with 9 or 10 rounded teeth on the margin and have a slight taper from margin to base". (Calkins).

Gonosome.—"Gonotheca large, borne on short, ringed stalk on the parent stem just above the axils of the branches; smooth, oval, and with a terminal aperture. The blastostyle as a rule bears three medusæ, the oldest of which are provided with a well marked manubrium and four tentacles; the diaphragm is a simple partition with down-turned edge at the aperture. The hydranth is limited by an annular ridge which, however, is not so pronounced as in the preceding species (*Campanularia inconspicua*), being more of a swelling. Cœnosarc very much attenuated in basal chamber, becoming gradually thicker as it approaches the stem. The basal chamber is a part of the stem". (Calkins).

Distribution.—Port Townsend, Scow Bay. (Calkins).

I have no specimens of this species. The description and figures are taken from Calkins. In its habitus it is very much like *Clytia edwardsi* and *Gonothyræa gracilis* but it is a more delicate species.

Clytia cylindrica Agassiz

Pl. XIII, Fig. 40

Clytia cylindrica AGASSIZ, Cont. Nat. Hist., U.S., IV, 1862, p. 306.

Clytia cylindrica NUTTING, Hydroids of Woods Hole, 1901, p. 342.

Clytia cylindrica FRASER, Hydroids of Beaufort, 1912, p. 358.

Trophosome.—Stem unbranched; the slender pedicel is annulated

proximally and distally; hydrotheca cylindrical, at least twice as deep as wide, suddenly constricted at the base where the diaphragm appears inside, the part below the diaphragm being little larger than the end of the pedicel. Teeth 10-12, sharp-pointed and rather deeply cut.

Gonosome.—Gonophores given off from the stolon, or occasionally from the pedicel, supported on short pedicels with one or two annulations; gonangium smooth, oblong or slightly obovate, narrowing slightly just below the brim.

Distribution.—Off Pt. Richardson, near Friday Harbor.

Torrey has described a species which he has named *Campanularia hesperia*[20] that as he says, shows little difference from *Clytia cylindrica* except in the number of the tentacles. The Friday Harbor specimens have the fewer number of tentacles corresponding to the eastern species and have the gonangium and contents similar to that form.

Clytia edwardsi (Nutting)

Pl. XIII, Fig. 41

Gonothyræa gracilis CALKINS, Some Hydroids of Puget Sound, 1899, p. 350.

Campanularia edwardsi NUTTING, Hydroids of Woods Hole, 1901, p. 346.

Clytia edwardsi FRASER, West Coast Hydroids, 1911, p. 34.

Clytia edwardsi FRASER, New England Hydroids, 1912, p. 44.

Trophosome.—Stem unbranched or with few or many irregularly placed branches; the stolon often forms a complicated network on *Fucus*, wormtubes, etc., but at other times passes along in a fairly regular direction. When the whole stem consists of a single pedicel, it is long and slender, annulated at the base and below the hydrotheca; when there is only one branch it turns abruptly in the direction of the main stem, almost at its base; it is also long and slender, overreaching the main stem, the branch often being as long as the main stem or even longer. On it the annulations are similarly arranged to those on the main stem; there are no annulations on the main stem immediately above where the branch is given off. When other branches are given off they bear a similar relation to the branch from which they spring as the first branch does to the stem, thus producing a loose cymose appearance. The whole colony may reach a height of 25 or 30 mm. The hydrothecæ are usually quite large but vary a large amount in size, deeply campanulate in shape, with 10-14 deeply-cut, slender teeth that are somewhat rounded at the tip.

[20] Hydroids of San Diego, 1904, p. 12.

Gonosome.—The gonangia grow anywhere, on the stolon, in the axils of the branches or directly from the stems or branches; they are oblong or oval, corrugated; they vary much in size and in the number of the corrugations; they are borne on short pedicels with 2 or 3 annulations.

Distribution.—Port Townshend (Calkins); San Juan Archipelago, Departure Bay (Fraser); very extensively distributed throughout the region; found at Banks I., China Hat, Lasqueti I., Nanoose Bay, several points near and in Departure Bay, north of Gabriola I., Northumberland Channel, Dodds Narrows, Pylades Channel, Gabriola Pass, Porlier Pass, Whaleboat Passage, Friday Harbor, San Juan Channel, Deer Harbor, Port Townshend.

The finding of the gonosome as reported in my New England paper, corresponding to the gonosome found here previously, fully bears out the conclusion that the species here corresponds exactly to the New England form.

I have been successful in keeping some of the free medusæ until the 8-tentacled stage was reached, at which time there were also 8 lithocysts.

Clytia inconspicua (Forbes)

Pl. XIII, Fig. 42

Thaumantias inconspicua FORBES, Br. Naked-eyed Medusæ, 1848, p. 52.

Thaumantias inconspicua WRIGHT, Quart. Jour. Micr. Sc., 1862, p. 221.

Campanularia inconspicua CALKINS, Puget Sound Hydroids, 1899, p. 349.

Thaumantias inconspicua FRASER, West Coast Hydroids, 1911, p. 40.

Trophosome.—Colony small, stem usually unbranched; pedicel short and slender, annulated or wrinkled throughout or with a small portion towards the centre smooth; hydrothecæ small with 7 blunt but distinctly cut teeth.

Gonosome.—Gonangia borne on the stolon by means of short, annulated pedicels, obovate, smooth; aperture terminal, large.

Distribution.—Puget Sound (Calkins); San Juan Archipelago (Fraser); Banks I., Departure Bay, Whaleboat Passage.

In the study of medusæ there has been a great deal of confusion in the case of the two genera, *Thaumantias* and *Phialidium.* The general distinction given is that *Thaumantias* has no lithocysts present in the margin while *Phialidium* has these. Many of the specimens studied and described have been preserved in formalin which is likely to be acid and hence will attack the small calcareous lithocysts so that they disappear in a very short time. I have observed that in speci-

mens of *Æquorea forskalea*, where the lithocysts are readily seen in the fresh specimens, they have entirely disappeared in less than two weeks. That being the case, many species are put in the genus *Thaumantias* that should be in the genus *Phialidium.* The species that Murbach and Shearer described from this coast as *Thaumantias cellularia* Haeckel[21], certainly has numerous lithocysts and apparently no real *Thaumantias* has been collected from this coast. Mayer in his Monograph, includes *Thaumantias inconspicua* Forbes with *Phialidium hemisphericum*,[22] and during the summer of 1912 evidence was obtained at the Departure Bay Station that corroborated this conclusion.

Calkins found some specimens of what he called *Campanularia inconspicua* in Puget Sound and later I found similar species in San Juan material and reported it as *Thaumantias inconspicua*, as there seemed little doubt that it was the same species in which Wright reared the hydroid from the medusa. Dr. McMurrich, while working on the medusæ of this region, successfully reared some hydroids from the eggs of *Phialidium hemisphericum* and these hydroids were not distinguishable from the hydroids I had referred to *Thaumantias inconspicua.* I have shown a figure of one of these reared hydroids that it may be compared with that of some specimens obtained from Banks Island.

The difficulty now is to know what the species should be called. Mayer says that the *Clytia* medusæ are distinguished from the *Phialidium* medusæ, in that they have the same number of lithocysts as tentacles, arranged alternately, while the latter have a greater number of lithocysts than tentacles and these are not regularly arranged. Since these medusæ are still in the four-tentacle stage when they are liberated from the gonangium, it would be a very difficult matter to make a classification that would effect the hydroid on that basis. As a matter of fact, that has not been done as every hydroid that produces medusæ that would answer to the description of either of these at the four-tentacled stage has been classified as a *Clytia*, and it is quite probable that many of the hydroids that are now called *Clytia* produce *Phialidium* medusæ. In fact, Dr. McMurrich found it impossible to distinguish the young stages of the medusæ of *Phialidium hemisphericum* from the medusæ that I obtained from the hydroid *Clytia edwardsi.* It seems best, therefore, to place the species in the genus *Clytia.*

But the difficulty does not end here. If the medusa *Thaumantias inconspicua* is the same as *Phialidium hemisphericum*, the name "*hemisphericum*" dates back to 1760 and it was not until 1848 that Forbes used the name "*inconspicua.*" It was the latter name, how-

[21] Proc. Zool. Soc. London, vol. 2, 1903, p. 172.

[22] Medusæ of the World, vol. 2, 1910, p. 266.

ever, that Wright applied to the hydroid when he reared it, and hence, although the name apparently was given under a misconception, it was the name originally applied to the hydroid. As up to the present time there has been no classification devised that would suit both medusæ and hydroids, the name "*inconspicua*" must be used for the species.

Clytia johnstoni (Alder)

Pl. XIV, Fig. 43

Campanularia johnstoni ALDER, Ann. and Mag. N.H., 2nd ser., 18, 1856, p. 359.

Clytia johnstoni CLARK, Alaskan Hydroids, 1876, p. 212.

Campanularia johnstoni CALKINS, Puget Sound Hydroids, 1899, p. 348.

Clytia bicophora TORREY, Hyd. of the Pacific Coast, 1902, p.l.

Clytia johnstoni FRASER, West Coast Hydroids, 1911, p. 36.

Trophosome.—Stem unbranched or sometimes with a single branch; pedicels annulated proximally and distally; hydrothecæ broadly campanulate, depth and width nearly equal; margin with 12-14 triangular teeth that may be sharp or slightly rounded.

Gonosome.—Gonophores growing either from the stem or the stolon, attached by short annulated pedicels; rather small as compared with others of the species of this genus, oval or oblong, truncate, corrugated; opening not large.

Distribution.—Puget Sound (Calkins); north of Gabriola I., Gabriola Pass.

Clytia kincaidi (Nutting)

Pl. XIV, Fig. 44

Campanularia kincaidi NUTTING, Hyd. from Alaska and Puget Sound, 1899, p. 743.

Campanularia kincaidi FRASER, West Coast Hydroids, 1911, p. 31.

Trophosome.—Stem unbranched, pedicels slender, annulated proximally and distally and sometimes with 2 or 3 annulations medially placed; hydrotheca small, tubular, long for the width, ribbed lengthwise, the line passing down for some distance from each tooth; teeth 8-10, distinctly and sharply pointed.

Gonosome.—(not previously described) Gonangium oval or obovate, gradually increasing in size from the base for about three-fourths of its length and then narrowing slightly; the pedicel is much longer than in any of the other species of *Clytia* described in this paper, having as many as 7 annulations.

Distribution.—Puget Sound (Nutting); Dodds Narrows (Fraser); Nanoose Bay, off Clarke Rock, Gabriola Pass, off Matia I., Friday Harbor.

This species varies much in size, some specimens being very minute; even at the largest it is not of great size. The fluted hydrotheca is characteristic but the wall is so thin that it is difficult sometimes to note the lines for any great distance form the margin.

Genus **EUCOPELLA**

Trophosome.—Stem unbranched, arising from an anastomosing stolon; hydrothecæ with very thick walls and smooth margins.

Gonosome.—Gonophores produce large medusoid structures, never more than two, one large and one small, in the gonangium at one time. They are of an elongated dome shape. They differ from ordinary medusæ in not having mouth or digestive cavity.

Eucopella caliculata (Hincks)

Pl. XIV, Fig. 45

Campanularia caliculata HINCKS, Ann. and Mag. N.H., 2nd ser., 11, 1853, p. 178.

Eucopella caliculata FRASER, West Coast Hydroids, 1911, p. 36.

Trophosome.—Stem unbranched serving as the pedicel for the hydranth, varying in length, slightly wavy or annulated, with a distinct double annulation below the hydrotheca; hydrotheca with very thick wall and entire margin.

Gonosome.—Gonangium large irregularly obovate, the distal end regularly rounded or somewhat truncate, attached to the stolon by means of a short pedicel. Within the gonangium are two medusoid structures one large occupying the greater portion of the space and a much smaller one below. These are of an elongated oval shape and when liberated are devoid of mouth and digestive cavity.

Distribution.—Pt. Wilson, Port Townshend, Bremerton (Calkins); San Juan Archipelago (Fraser); off Massett, Dodds Narrows, Gabriola Pass, off Matia I., off Fossil I., Friday Harbor, particularly abundant in material from Pt. Richardson, growing on red algæ, Coupeville, Pt. Grenville.

Genus **GONOTHYRÆA**

Trophosome.—As in the family.

Gonosome.—Reproduction by fixed medusiform sporosacs furnished with tentacles, that at maturity become extracapsular, remaining attached until their contents are discharged.

Key to species of *Gonothyræa* found in the Vancouver I. region.

A. Hydrotheca with castellated margin................*G. clarki*
B. Hydrotheca with deeply cut, acute teeth........... *G. gracilis*
C. Hydrotheca with entire margin................... *G. inornata*

Gonothyræa clarki (Marktanner-Turneretscher)

Pl. XIV, Fig. 46

Laomedea (*Gonothyræa*) *clarki* MARKTANNER-TURNERETSCHER, Hydroiden von Ostspitzbergen, 1895, p. 408.

Gonothyræa clarki FRASER, West Coast Hydroids, 1911, p. 37.

Trophosome.—Colonies branched, stem and branches slender, internodes long; main stem annulated above each of the branches; branches annulated at the base and above the origin of smaller branches and pedicels; hydrotheca pedicels arranged alternately, the branches slightly geniculate where they are given off, short and usually annulated throughout; hydrothecæ deeply campanulate narrowing very slightly in the distal half and somewhat more in the proximal; margin with 10–12 sharply truncated teeth, giving a castellated appearance to the hydrothecæ.

Gonosome.—Gonangium oval or oblong, usually growing in the axils of branches or pedicels but occasionally taking the place of hydrothecæ; medusoids four or five in each gonangium.

Distribution.—Bare Island (Hartlaub); Departure Bay, San Juan Archipelago (Fraser); Departure Bay, Nanaimo, Dodds Narrows, Gabriola Reefs, Friday Harbor.

This species was quite common on the rocks in Departure Bay and on the floats in Nanaimo Harbor. In April the gonosome was present and it was possible to obtain various stages in the development of the planulæ. There was little evidence that fertilization takes place within the capsule, although in one or two cases the ova showed signs of division. In no case was there any sign of tentacles on the medusoid until after its escape from the gonangium. The number of ova in a sporosac varies from 1 to 4. The developing planulæ are not placed in any definite position in the sporosac but are found lying in all directions.

Gonothyræa gracilis (Sars)

Pl. XV, Fig. 47

Laomedea gracilis SARS, Beretning om en Zool. Reise i Lofoten og Finmarken, 1851, p. 18.

Gonothyræa gracilis ALLMAN, Ann. and Mag. N.H., 3rd ser., 13, 1864, p. 374.

Gonothyræa gracilis HINCKS, British Hydroid Zoophytes, 1868, p. 183.

Trophosome.—Colony irregularly branched; stem, branches and pedicels long and slender; branches and pedicels bend abruptly near the origin and pass upward in the same direction as the main stem; stem with several annulations at the base and above the origin

of each branch and pedicel, each pedicel with several annulations at the base and below the hydrotheca; hydrotheca long for its width, cylindrical for the upper half or two-thirds and gradually tapering to the base; teeth 10–14, deeply cut and rather sharp.

Gonosome.—Gonophores borne on the stolon and on the stem, with distinctly annulated pedicels; gonangia oblong-oval, often flaring a little at the rim; each gonophore bears four or five sporosacs.

Distribution.—Departure Bay, West of Hammond Bay, off West Rocks, off Snake I., north of Gabriola I., Northumberland Channel, Dodds Narrows, Gabriola Pass, off Matia I., Friday Harbor.

Calkins reported a species that he called *Campanularia gracilis* from Port Townshend, but his enlarged figure of a gonophore is certainly that of a *Clytia*, probably that of *Clytia edwardsi*, which species is very much similar in its general appearance to *Gonothyræa gracilis*. His enlarged hydrotheca also looks more like the *Clytia* hydrotheca but the drawing which is not so much enlarged might be either the one or the other. The gonophores here look more like those of *G. gracilis*. It is quite possible that he had both of these species in his material.

In the majority of specimens obtained, the size of the gonangia as well as that of other parts of the colony correspond well with those specimens obtained along the Atlantic Coast, the height of the gonangium being ·75 or ·8 mm., but in a few cases a great increase in size was observed, some being found with a length of over 2 mm. This difference is represented in the figures.

Gonothyræa inornata Nutting

Pl. XV, Fig. 48

Gonothyræa inornata Nutting, Harriman Hydroids, 1901, p. 175.
Gonothyræa inornata Fraser, West Coast Hydroids, 1911, p. 37.

Trophosome.—Colony reaching a height of 50 mm.; main stem dividing near the base into several branches that pass directly upward, usually without any further branching; hydranth pedicels given off alternately in the same plane; branches annulated, usually three annulations, above the origin of the pedicels. There is a slight tendency to geniculation. Pedicels short, annulated throughout; hydrotheca funnel-shaped, margin entire.

Gonosome.—Gonophores borne in the axils of the pedicels, or taking the place of pedicels, on short annulated pedicels, obconic, truncate distally, smooth or with a slight tendency to corrugation; there is but one sporosac in each gonangium.

Distribution.—Friday Harbor.

Genus **OBELIA**

Trophosome.—Stem branched, simple or fascicled.

Gonosome.—Reproduction by means of free medusæ which are flattened dorso-ventrally and when liberated possess more than eight tentacles. Eight interradial lithocysts are present.

Key to the species of *Obelia* found in the Vancouver I. region.

A. Stem fascicled
 a. Stem erect, hydrotheca with entire margin....... *O. plicata*
 b. Stem clinging, hydrotheca with sinuous margin.... *O. fragilis*
 c. Stem erect, teeth with two cusps.......... *O. multidentata*
B. Stem simple
 a. Colony large
  1. Hydrotheca margin entire................. *O. borealis*
  2. Hydrotheca margin sinuous............ *O. longissima*
 b. Colony small
  1. Very much branched...................... *O. griffini*
  2. Not very much branched
   i. Margin sinuous, hydrotheca with vertical lines... .... *O. dubia*
   ii. Margin polyhedral.................. *O. dichotoma*
   iii. Margin entire, stem unbranched or very slightly branched......................... *O. gracilis*
   iv. Margin entire, stem with branches alternately arranged......................... *O. surcularis*

Obelia borealis Nutting

Pl. XV, Fig. 49

Obelia borealis NUTTING, Harriman Hydroids, 1901, p. 174.
Obelia borealis FRASER, West Coast Hydroids, 1911, p. 38.

Trophosome.—Colony very large (Nutting reports it up to 18 inches), stem long and slender; main branches long and spreading, given off in pairs or singly, the stem often sinuous at the nodes; stem and branches with 3 or 4 annulations above the nodes; pedicels either short and entirely annulated or long and annulated only at each end; hydrotheca funnel-shaped; margin entire.

Gonosome.—Gonangia borne in the axils on annulated pedicels, obovate, a collar present, aperture large; surface smooth or with a slight tendency to corrugation.

Distribution.—Ucluelet, San Juan Archipelago (Fraser); off Massett, Naden Harbor, Bull Harbor.

Obelia dichotoma (Linnæus)

Pl. XV, Fig. 50

Sertularia dichotoma LINNÆUS, Syst. Nat., 1758, p. 812.
Obelia dichotoma FRASER, West Coast Hydroids, 1911, p. 38.

Trophosome.—Stem slender, erect, seldom more than 25 mm. high, sometimes without branches but usually with branches irregularly given off and these may be as long as the main stem so that they have a dichotomous appearance; 3–4 annulations on stem and branches above the nodes; pedicels rather short, given off in regular alternation, usually annulated throughout; hydrotheca funnel-shaped with polyhedral margin.

Gonosome.—Gonangia borne in the axils on short annulated pedicels, obovate, smooth, with a distinct collar which tapers from base to margin; aperture rather small.

Distribution.—Bremerton (Calkins); Departure Bay, San Juan Archipelago (Fraser); Alert Bay, off Protection I., off Matia I., off Waldron I.

Obelia dubia Nutting

Pl. XVI, Fig. 51

Obelia dubia NUTTING, Harriman Hydroids, 1901, p. 174.
Obelia dubia FRASER, West Coast Hydroids, 1911, p. 38.

Trophosome.—Colony small, reaching a height of 25 mm., slightly and irregularly branched, extensively annulated; pedicels usually rather long and annulated throughout; hydrotheca large with broad, shallow, rounded teeth; vertical lines pass downward from the margin for some distance from the indentations.

Gonosome.—Gonangia borne in the axils on annulated pedicels, pear-shaped, with a distinct but low collar and small aperture; surface almost smooth or provided with broad shallow corrugations.

Distribution.—Departure Bay, Dodds Narrows, Ucluelet, San Juan Archipelago, Queen Charlotte Is. (Fraser); Neck Pt., Five Finger Islands, Snake I., Northumberland Channel, Gabriola Pass, Friday Harbor.

This species was always found in shallow water. In its early stages it looks very much like the early stages of *Obelia longissima* so much so that I find it impossible to distinguish between them at times but in the mature state there is not so much resemblance between the short, annulated stems of *O. dubia* and the long much branched colonies of *O. longissima*.

? **Obelia fragilis** Calkins

Pl. XVI, Fig. 52

Obelia fragilis Calkins, Puget Sound Hydroids, 1899, p. 355.
Obelia fragilis Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.—"Hydrocaulus clinging and never erect. Stem polysiphonic long, flexuous, branched at regular intervals, branches also comparative long and flexuous, slightly ringed at the base and with 4 rings above each branch. Hydrothecæ deeply bell-shaped; the chitinous periderm is exceedingly delicate and easily wrinkled or folded. Hydrothecæ placed alternately at some distance apart. Margin sinuous. Stems short and annulated throughout, a large hydrotheca in the axil of each branch." (Calkins).

Gonosome.—Unknown.

Dimensions.—"Length of colony 30 mm.; length of branches 9 mm.; distance between branches 1·5 mm.; length of hydrotheca ·5 mm., width of margin ·4 mm., number of tentacles 22–24." (Calkins).

Distribution.—Dredged in Port Townshend Harbor on *Aglaophenia struthionides.* (Calkins).

I do not know this species and hence have given Calkins' description and figures throughout.

Obelia gracilis Calkins

Pl. XVI, Fig. 53

Obelia gracilis Calkins, Puget Sound Hydroids, 1899, p. 353.
Obelia gracilis Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.—Colony small, stem slender, reaching a height of 20 mm., either entirely without branches or with few small branches; stem somewhat zigzag with one or two hydranth pedicels given off at each bend; a branch and one hydranth pedicel may be given off at each of the lower nodes, a little higher up two hydranth pedicels, one much longer than the other but bearing a smaller hydrotheca, while at the more distal nodes there is usually but one pedicel to the node; sides of the hydrotheca slightly convex, margin entire.

Gonosome.—Gonangia take the place of the lower hydrothecæ, generally but one hydrotheca at a node is so replaced but occasionally both of them are. The gonangia are rather slender, increasing in size from the base upwards, either smooth or somewhat irregular but scarcely corrugated; the distal portion ends in a distinct collar.

Distribution.—Scow Bay, Port Townshend (Calkins); San Juan Archipelago (Fraser); San Juan Archipelago, Port Townshend.

Obelia griffini Calkins

Pl. XVI, Fig. 54

Obelia griffini CALKINS, Puget Sound Hydroids, 1899, p. 357.
Obelia griffini FRASER, West Coast Hydroids, 1911, p. 39.

Trophosome.—Stems much branched, giving the colony a decidedly bushy appearance although it seldom reaches a height of 50 mm. and is often not more than half that; stem and branches annulated above the nodes; the shorter pedicels are annulated throughout and sometimes the longer ones are also but at other times there is a smooth place in the centre; hydrothecæ campanulate with convex sides, margin entire.

Gonosome.—The gonangia are borne in the axils on annulated pedicels, more slender than usual in *Obelia* species, very gradually increasing in diameter from base to apex, smooth or slightly wavy; collar distinct.

Distribution.—Puget Sound (Calkins); Departure Bay (Fraser); Ucluelet, Dodds Narrows, Gabriola Pass, Porlier Pass, Friday Harbor, off Sucia Is., Pt. Townshend, West Seattle.

Obelia longissima (Pallas)

Pl. XVI, Fig. 55

Sertularia longissima PALLAS, Elench. Zooph., 1766, p. 119.
Obelia longissima FRASER, West Coast Hydroids, 1911, p. 39.

Trophosome.—Stem filiform of great length, sometimes reaching 50 or 60 cm.; much branched, branches alternate; stem usually sinuous where the branches are given off; stem horn color or in old specimens quite black, annulated at base and above each node as are also the branches; pedicels short and annulated throughout or longer and annulated at each end; hydrothecæ campanulate; margin wavy but sometimes the waves are so shallow as to be almost imperceptible.

Gonosome.—Gonangia in the axils, oval, with a distinct collar and rather small aperture, usually smooth but sometimes corrugated.

Distribution.—Banks I., Departure Bay, Dodds Narrows, San Juan Archipelago (Fraser); everywhere in the vicinity of Departure Bay, Lasqueti I., Nanoose Bay, Dodds Narrows, Gabriola Pass, Sucia Is., Friday Harbor, West Seattle, Port Townshend, Griffin Bay, Clayuquot Sound.

This is the commonest shallow water campanularian in the region. It grows throughout the whole year on the station float, Departure Bay, and medusæ are freed at many times during the year. The medusæ as they are freed usually have 26 tentacles but sometimes the number is 1 or 2 short of that.

? **Obelia multidentata** new species

Pl. XVII, Fig. 56

Trophosome.—Colony much branched; main stem and larger branches show a tendency towards fasciculation; branches given off alternately with some degree of regularity, but they are not all in the same plane; pedicels on the more distal branches usually short and annulated throughout; extra pedicels often occur in the axils of the shorter ones as well as in the axils of the branches, which are much longer than the regular pedicels and annulated only at each end. On the stem and branches there are 2 or 3 annulations above each node; hydrothecæ large with numerous teeth, 20-24, that are very distinctly cut and either cut off squarely at the tip so that there are sharp points where the end meets the sides, or they may be more rounded so that the sharp points are not so noticeable; striæ pass downward from the margin at the bases of the cavities between the teeth. The fluting is so distinct that it appears as though the hydrotheca were made of separate segments, with adjacent margins turned inward together.

Gonosome.—Unknown.

Color.—The color of the main stem and larger branches is dark green almost black and the smaller branches a lighter green.

Distribution.—Friday Harbor.

Obelia plicata Hincks

Pl. XVII, Fig. 57

Obelia plicata Hincks, Br. Hydroid Zoophytes, 1868, p. 159.

Obelia plicata Marktanner-Turneretscher, Die Hydroiden des k.k. Nat. Hofmuseums, 1890, p. 208.

Obelia plicata Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.—Stem fascicled; branches numerous, some of them fascicled, at least in the proximal portion; stem and branches with 2 or 3 annulations above each of the nodes; pedicels long with several annulations at each end, but there may be a shorter pedicel in the axil of the longer and this is annulated throughout; hydrotheca campanulate, with slightly everted, entire margin.

Gonosome.—I have not seen the gonosome and Hincks did not describe or figure it but Marktanner states that it is similar to that of *O. dichotoma.*

Distribution.—Puget Sound (Nutting); Puget Sound (Calkins); Departure Bay, San Juan Archipelago (Fraser); Pt. Townshend.

Obelia surcularis Calkins

Pl. XVII, Fig. 58

Obelia surcularis CALKINS, Hydroids of Puget Sound, 1899, p. 355.
Obelia surcularis FRASER, West Coast Hydroids, 1911, p. 40.

Trophosome.—Colonies grow from a branched stolon; each main stem gives rise to several branches arranged in quite regular alternation; stems and large branches usually end in long tendrils that may or may not have hydrothecæ at the distal ends; on the branches the internodes are often quite short; stem and branches annulated above the nodes; pedicels annulated throughout or at the ends only; hydrothecæ regularly campanulate with the margin sometimes slightly everted; margin entire.

Gonosome.—Gonangia numerous in the axils of the branches and pedicels towards the base of the colony; they are rather long expanding gradually from base to extremity; collar low.

Distribution.—On water grasses abundant in Scow Bay, Port Townshend (Calkins); Kanaka Bay.

Family **Campanulinidæ**

Trophosome.—Colonies branched or unbranched, hydrothecæ pedicellate or sessile, always operculate, the operculum formed of converging segments; hydranths with conical proboscis.

Gonosome.—Gonophores producing planulæ or free medusæ.

Key to the genera of Campanulinidæ in the Vancouver I. region.

A. Hydrotheca pedicellate
  a. Hydrothecal margin distinct
    1. Hydrotheca tubular . . . . *Calycella*
    2. Hydrotheca turbinate . . . . *Lovenella*
    3. Operculum shaped like an A-tent . . . . *Stegopoma*
  b. Hydrothecal margin indistinct
    1. Hydrotheca oval or ovate; reproduction by free medusæ . . . . *Campanulina*
    2. Hydrotheca elongated oval; reproduction by fixed sporosacs . . . . *Opercularella*
B. Hydrotheca sessile
    Hydrotheca tubular; margin not very distinct . . . . . *Cuspidella*

Genus **CALYCELLA**

Trophosome.—A creeping stolon gives rise to tubular hydrothecæ on annulated pedicels; hydrothecal margin distinct.

Gonosome.—Gonangia borne on the solon; acrocysts are produced.

Calycella syringa (Linnæus)

Pl. XVII, Fig. 59

Sertularia syringa LINNÆUS, Syst. Nat., 1767, p. 1311.
Calycella pygmæa FRASER, West Coast Hydroids, 1911, p. 41.
Calycella syringa FRASER, West Coast Hydroids, 1911, p. 42.

Trophosome.—Stem smooth, not reticulated; hydrotheca tubular, margin distinct; operculum of 8-9 segments; reduplication of margin often occurs. There is an extreme amount of variation in the size of the hydrotheca and the length of the pedicel but in all cases the pedicel is annulated throughout.

Gonosome.—Gonangia borne on the stolon, pedicel with two or three annulations, oval or obovate; sporosacs are extruded into an acrocyst.

Distribution.—Port Townshend (Calkins); Puget Sound (Nutting); Bare I. (Hartlaub); Queen Charlotte Is., Banks I., Departure Bay, Dodds Narrows, San Juan Archipelago (Fraser); found almost everywhere in the region where dredging has been done.

The genus *Calycella* has given me much worry. It is widely distributed along both the Atlantic and the Pacific coasts of North America and it has been difficult to decide as to whether one species or two are to be found. The variation is so extreme that it seemed scarcely possible that the larger variety could be the same species as the smaller, particularly so as there seemed to be a gap in the gradation at a point between the two sizes. In the larger variety the hydrothecæ were found up to ·8 mm. in length and in the smaller variety hydrothecæ as short as ·2 mm. were found.

In all material previously reported upon, I was unable to find any gonangia with the variety that seemed to correspond to *Calycella pygmæa* Alder, and I could not find any indication that it had been found for this species by any one else, hence it seemed better to report the large specimens as *Calycella syringa* and the smaller as *C. pygmæa*. Now I have found gonangia in colonies with the smaller type of hydrotheca and although smaller than those found with the larger type they do not differ in any other particular. As this is the same particular in which the hydrothecæ differ, I must conclude that all belong to the one species in which there is an extreme amount of variation. The figures will show rather extreme cases of both hydrothecæ and gonangia.

Genus CAMPANULINA

Trophosome.—Stem usually branched but not always so; hydrotheca oval or ovate, margin not distinct; segments of the operculum rather long and slender.

Gonosome.—"Gonangia producing bell-shaped medusæ, with four radial canals, two to four marginal tentacles and eight lithocysts" (Nutting).

This description of Nutting's must refer to the medusa at time of liberation from the gonangium as later the radial canals, tentacles and lithocysts are more numerous.

Key to the species of Campanulina in the V. I. region.

A. Colony minute; base of hydrotheca forming a right angle with the sides .... *C. forskalea*

B. Colony larger; base of hydrotheca little wider than the end of the pedicel .... *C. rugosa*

? **Campanulina forskalea** (Peron et Lesueur)

Pl. XVII, Fig. 60

Æquorea forskalea Peron et Lesueur, Ann. Mus. Nat. Hist., tome 14, 1809, p. 336.

Campanulina forskalea Fraser, West Coast Hydroids, 1911, p. 43.

Trophosome.—Stem unbranched or slightly branched; hydrotheca oval or oblong, contracting abruptly at the base so that the base forms almost a right angle with the sides, terminating above in about 12 converging segments; hydranth with 12 tentacles.

Gonosome.—Unknown.

Distribution.—San Juan Archipelago (Fraser); near Round I. in Dodds Narrows.

I have little to add to the description given in the previous paper. For a long time I looked in vain for other specimens and it may be that I had collected some but as they were so small they were overlooked. Finally on June 18, 1913, I found several specimens in good condition on some small green algæ that were dredged in a depth of about 20 fathoms west of Round Island in Dodds Narrows. They were all unbranched and much similar in size.

The medusa *Æquorea* may be found in abundance in this locality at almost all times of the year. If this hydroid is developed from that medusa, as it probably is, it should be possible to find plenty of specimens to trace the development but up to the present that has not been the case.

Campanulina rugosa Nutting

Pl. XVII, Fig. 61

Campanulina rugosa Nutting, Harriman Hydroids, 1901, p. 176.

Campanulina rugosa Fraser, West Coast Hydroids, 1911, p. 44.

Trophosome.—Colony small, seldom over 10 mm., stem irregularly branched or even unbranched; it gives rise to the hydranth pedicels in regular alternation; commonly the pedicel appears as though it were the continuation of the stem below its origin while the continued portion of the stem appears like a branch given off from it; this makes a distinct geniculation; where there are branches given off the regularity is interfered with; stem, branches and pedicels are all annulated throughout; the pedicels are short with 3 or 4 annulations; hydrothecæ rather stout for the length, almost oval in shape; opercular segments 10–12, about one-third of the total length of the hydrotheca.

Gonosome.—Gonangia in the axils of the lower branches and pedicels, nearly oblong but tapering slightly towards the base and somewhat flattened at the distal end; each gonangium produces a single medusa.

Distribution.—West Seattle (Fraser); West Seattle.

The material recently examined may be some of the same lot as that reported previously as it was in the University of Washington collection and that reported was also from Prof. Kincaid's collection. The species that Hartlaub describes as *C. chilensis* from the coast of Chile,[23] looks very much the same as this species. If it is the same species it has rather an unusual distribution as Nutting originally described it from Juneau, Alaska, and it has not been reported elsewhere except in the above reference.

Genus **CUSPIDELLA**

Trophosome.—Hydrothecæ sessile on a creeping rootstock, tubular.

Gonosome.—Unknown.

Key to the species of Cuspidella found in the Vancouver I. region.

A. Hydrotheca large .... *C. grandis*
B. Hydrotheca small .... *C. humilis*

Cuspidella grandis Hincks

Pl. XVIII, Fig. 62

Cuspidella grandis Hincks, Br. Hydroid Zoophytes, 1868, p. 210.

Trophosome.—Sessile, tubular hydrothecæ grow from a regularly creeping stolon; length may reach ·8 mm. and diameter about ·15 mm.; operculum of 8–10 segments.

Gonosome.—Unknown.

[23] Die Hydroiden der Magalhaenischen Region und Chilenschen Küste, 1905, p. 589.

Distribution.—Rose Spit, Departure Bay.

I see nothing to distinguish this from *C. humilis* except its size but it agrees with Hincks' *C. grandis* and I have therefore recorded it as a separate species. It may be that, as in the case of *Calycella syringa*, there is but one species with great variation in size. Since no gonosome has been found in the case of either it makes it even more difficult to decide if it is wise to make two species.

Cuspidella humilis (Alder)

Pl. XVIII, Fig. 63

Campanularia humilis ALDER, Trans. Tyneside Nat. F.C., 1862, p. 239.
Cuspidella humilis FRASER, West Coast Hydroids, 1911, p. 44.

Trophosome.—Stolon much more slender than in *C. grandis*; hydrothecæ stouter in comparison with their length but quite minute, cylindrical, sessile; operculum of 10-12 segments.

Gonosome.—Unknown.

Distribution.—Departure Bay, San. Juan Archipelago (Fraser); off Clarke Rock, north of Gabriola I., Northumberland Channel, Dodds Narrows, Pylades Channel, Gabriola Pass, Ruxton Passage, Whaleboat Passage, Friday Harbor.

Genus **LOVENELLA**

Trophosome.—Colony branched or unbranched; hydrotheca turbinate; operculum sharply defined by a sinuous margin on the tube of the hydrotheca.

Gonosome.—"Gonangia borne on the stems, producing free, bell-shaped medusæ with eight tentacles in two sets, and four lithocysts". (Nutting).

Lovenella producta (Sars)

Pl. XVIII, Fig. 64

Calycella producta SARS, Norges Hydroider, 1873, p. 30.
Lovenella producta FRASER, West Coast Hydroids, 1911, p. 44.

Trophosome.—Stems radiate in all directions from an irregularly branched stolon, often densely aggregated, usually unbranched but occasionally with one or two branches which grow out almost at right angles and then turn upward to overtop the stem; pedicels vary much in length up to 6 mm., annulated at the base and more or less annulated throughout the remainder; they pass almost imperceptibly into the turbinate hydrothecæ; margin of hydrotheca very distinctly scalloped for the base of the segments of the operculum, 12 or more in number;

the portion of the hydrotheca nearest the operculum may be ribbed longitudinally. As is the case with the majority of the *Campanulinidæ* the operculum may be inverted.

Gonosome.—Unknown.

Distribution.—Dodds Narrows, San Juan Archipelago (Fraser); common, found off Lasqueti I., Nanoose Bay, off West Rocks, off Clarke Rock, Departure Bay, north of Gabriola I., east of Protection I., Northumberland Channel, Dodds Narrows, Gabriola Pass, Whaleboat Passage, off Matia I., Griffin Bay, Friday Harbor.

In looking over some specimens of this species from Griffin Bay and others from West Rocks, I found that several of them had from 1 to 3 appendages very similar to those described by Allman in *Oplorhiza parvula* [24] which he described as being "in the form of tubular receptacles with an orifice in the summit, which enclose a granular, fleshy column, supporting a cluster of thread-cells." In his species, however, they are found on the hydrorhiza while here they are found on the pedicel a short distance below the hydrotheca. On this characteristic he instituted the new genus *Oplorhiza.* More recently, Pictet and Bedot found a species in material from the Gulf of Gascony that they named *Campanularia armata*,[25] in which appendages spoken of as being small, spherical, pedunculate nematophores, were found growing from the tubes of the polysiphonic stem. They did not consider it necessary to make a new genus for the species but retained it in the genus *Campanularia.* The appendages above referred to, are even more like these last mentioned. The species, *Lovenella producta*, is widely distributed in the region, but only in the specimens from the localities mentioned have I seen anything of these appendages, the presence of which has been considered of specific and even of generic value.

Genus **OPERCULARELLA**

Trophosome.—Hydrotheca elongated-oval with no distinct margin; operculum segments long and narrow.

Gonosome.—Reproduction by sporosacs which are extruded into an acrocyst.

Opercularella lacerata (Johnston)

Pl. XVIII, Fig. 65

Campanularia lacerata Johnston, Br. Zoophytes, 1847, p. 111.
Opercularella lacerata Hincks, Br. Hydroid Zoophytes, 1868, p. 114.

Trophosome.—Stem short, reaching a height of 15-25 mm.,

[24] Mem. Mus. Comp. Zool., Harvard, vol. V, no. 2, 1877, p. 14.
[25] Hydraires provenant des Campagnes de l'Hirondelle, 1900, p. 9.

branched, some of the branches being almost as long as the main stem; stem and branches flexuous, annulated throughout; pedicels rather short, annulated; hydrotheca with proximal portion oval and distal portion conical, no distinct margin; segments long and slender; hydranths long and slender with 14-15 tentacles.

Gonosome.—Female gonangia oval, sessile or on short annulated pedicels, in the axils or taking the place of hydrothecæ; sporosacs extruded into an acrocyst; male gonangia similar in position to the female but more nearly cylindrical in shape.

Distribution.—On *Gonothyræa clarki*, found at low tide at Jesse I., Departure Bay.

Genus **STEGOPOMA**

Trophosome.—Hydrotheca with an operculum formed of two membranes folded lengthwise, and which come together, roof-like, with their long edges; each of these is separated from the remainder of the hydrotheca by a curved line; at each side the hydrothecal wall forms a triangular, gable-like structure, between the two opercular membranes.

Gonosome.—Levinsen, who established this genus, gave no characters for the gonosome and no one seems to have done so since. In some cases at least, probably in all, reproduction takes place by fixed sporosacs.

Stegopoma plicatile (Sars)

Pl. XVIII, Fig. 66

Lafœa plicatile Sars, Selsk. Forhandl., 1862, p. 31.

Stegopoma plicatile Levinsen, Meduser, Ctenophorer og Hydroider, 1893, p. 36.

Stegopoma plicatile Fraser, West Coast Hydroids, 1911, p. 45.

Stegopoma plicatile Broch, Coelentérés du Fond, 1912, p. 11.

Trophosome.—Stem large, strongly fascicled, the number of tubes in the fascicle being from 3 up; only the extremity of the branchlets are simple; the hydrothecæ are long and almost tubular, sometimes straight, but more commonly curved, often with a short pedicel but sometimes sessile or even in lateral contact with the branch; operculum consisting of the regular two membranes meeting along a ridge, with the walls of the hydrotheca produced to form the gable and to support the operculum. Broch speaks of a creeping variety as well as the erect, but I have seen no specimens of it.

Gonosome.—I have not obtained any gonangia nor have I seen any good figure of one. Sars says the gonangia are large, cylindrical,

with opening at the distal end. They are found scattered over the colony. The wall is covered with a chitinous network, formed by shoots from the branches. Levinsen says they are formed like a long sack, growing to the branches for a greater part of their length. Broch says that in the creeping colonies, the gonangia can be distinguished from the hydrothecæ only by their shorter pedicels, while in the erect colonies, the gonangia are greatly elongated, oviform, fixed to the stem by the tapering extremity. Judging from Levinsen's small scale drawing, the oval gonangium is about three times the length of the hydrotheca.

Distribution.—Off Lasqueti I., West Rocks, north of Gabriola I., Gabriola Reefs.

Family **Halecidæ**

Trophosome.—Hydrothecæ reduced to saucer-shaped hydrophores, which usually pass without constriction into the broad, tubular pedicels; they are too small to lodge the contracted hydranth; margin entire, often flaring; reduplication common; hydrophore with a circle of bright dots just below the rim; hydranths with conical proboscis.

Gonosome.—Gonophores producing fixed sporosacs.

Key to the genera of Halecidæ found in the Vancouver I. region.

A. Tentacular organs absent .... *Halecium*

B. Tentacular organs present .... *Ophiodes*

Genus **HALECIUM**

Trophosome.—As in the family; no tentacular organs present.

Gonosome.—Gonangia usually different in the two sexes.

Key to the species of *Halecium* found in the Vancouver I. region.

A. Stem simple
- a. Strongly annulated
  - 1. Stem erect.............................. *H. annulatum*
  - 2. Stem creeping.............................. *H. corrugatum*
- b. Not strongly annulated
  - 1. Stem stout, wall of hydrotheca stout....... *H. kofoidi*
  - 2. Stem very slender, often wavy........... *H. tenellum*
  - 3. Colony low, without continuous stem..... *H. pygmæum*

B. Stem fascicled
- a. Hydrophores sessile, borne directly on broadened shoulders of internodes of the stem.

1. Stem with few branches, either primary or secondary .... *H. articulosum*
2. Stem much branched making a dense colony . . *H. scutum*

b. Hydrophores borne on distinct pedicels
1. Delicate branches grow directly from strongly fascicled stem.
   i. Hydrophore pedicel arising from distal end of internode ....*H. flexile*
   ii. Hydrophore pedicel at proximal end of internode ....*H. reversum*
2. Branches fascicled to some extent
   i. Primary branches short, not much branched Gonangia barnacle-shaped...... .. *H. washingtoni*
   ii. Primary branches with numerous branches
      a. Branchlets very numerous throughout the whole length of the branches..............*H. densum*
      aa. Branchlets at distal end of branches only.... .... *H. parvulum*
      aaa. Branching flabellate, gonangia circular, with terminal opening ....*H. wilsoni*
      aaaa. Branching flabellate, gonangia oblong-oval.... .... *H. labrosum*
      aaaaa. Branching pinnate, gonangia with two hydranths in opening........... ...*H. halecinum*

Halecium annulatum Torrey

Pl. XIX, Fig. 67

Halecium annulatum Torrey, Hyd. of the Pacific Coast, 1902, p. 49.
Halecium annulatum Fraser, West Coast Hydroids, 1911, p. 46.

Trophosome.—Delicate stems arising from a stolon, the larger of which are branched irregularly; stem and branches annulated throughout in some cases regularly and in others irregularly; hydrothecæ arising from the stem, sessile or nearly so, from the branches on longer pedicels; reduplication common, with long pedicels between the hydrophores.

Gonosome.—"Female gonothecæ broadly ovate, excessively compressed, with terminal aperture, single gonophore with numerous ova, surrounded by blastostylar processes reaching to gonothecal wall." (Torrey).

Distribution.—Port Renfrew, Ucluelet, Dodds Narrows (Fraser).

The gonangia were not present in specimens obtained. The description and the figure of these are taken from Torrey.

Halecium articulosum Clark

Pl. XIX, Fig. 68

Halecium articulosum CLARK, New England Hydroids, 1876, p. 63.
Halecium articulosum NUTTING, Hydroids of Woods Hole, 1901, p 357.
Halecium articulosum JÄDERHOLM, Northern and Arctic Invert., 1909, p. 58.

Trophosome.—Stem coarse, fascicled, primary branches scarce but long, hence the colony has a very loose appearance, ultimate branches pinnately arranged, white, distinct from the larger branches and main stem which are dark brown; internodes short and getting shorter towards the end of the branches, where they may be as broad as long; hydrothecæ sessile, alternately arranged, one distally, on each internode.

Gonosome.—Female gonangia large, obovate, borne in rows on the upper side of the branches, aperture lateral but near the distal end. "Male gonangia are oblong, subcylindrical, sessile" (Clark).

Distribution.—Jumbo Channel (from University of Washington). Only female colonies were obtained.

Halecium corrugatum Nutting

Pl. XIX, Fig. 69

Halecium corrugatum NUTTING, Hyd. from Alaska and Puget Sound, 1899, p. 745.
Halecium corrugatum FRASER, West Coast Hydroids, 1911, p. 47.

Trophosome.—Colony creeping, stem bearing but one hydrophore, or branching sufficiently to bear as many as 3 or 4; these arranged very irregularly on the stolon; the stolon is not annulated but the pedicels are distinctly and regularly annulated throughout; margin everted but not very strongly.

Gonosome.—(Not previously described) Gonangia borne directly on the stolon with scarcely a sign of pedicel; the proximal half is larger, after this the gonangium narrows gradually almost to the distal end when the diameter is again increased; aperture occupying all the distal end; surface smooth.

Distribution.—Puget Sound (Nutting); Clayuquot Sound, Nanoose Bay, north of Gabriola Island, off Matia I.

Halecium densum Calkins

P. XIX, Fig. 70

Halecium densum CALKINS, Hyd. from Puget Sound, 1899, p. 343.
Halecium densum FRASER, West Coast Hydroids, 1911, p. 47.

Trophosome.—Stem stout, fascicled, densely branched; one, two or three branchlets or pedicels may arise from the same node; distally the pedicels are often in groups of three; the node is not always distinctly marked but usually shows plainly just above the branch or pedicel is given off; branches and pedicels may be wavy in outline; hydrophores with much everted rim.

Gonosome.—Unknown.

Distribution.—Bremerton (Calkins); Port Renfrew, Ucluelet San Juan Archipelago (Fraser); off Massett, off Rose Spit, Dodds Narrows, off O'Neale I., Friday Harbor, Puget Sound.

Halecium flexile Allman

Pl. XX, Fig. 71

Halecium flexile, ALLMAN, Challenger Report, pt. 2, vol. 23, 1888, p. 11.
Halecium flexile HARTLAUB, Die Hyd. der Magal. region, 1905, p. 611.

Trophosome.—Main stem coarse, erect, strongly fascicled; the branches coming off from the main stem are simple and unbranched except that a small proximal portion may be fascicled, pinnately arranged with much regularity; each branch usually passes to its extremity without forking. The branch is divided into internodes by nodes that are nearly transverse; from the distal end of each internode is given off the pedicel for a hydrophore, this pedicel being long but showing no sign of a joint; commonly the hydrophore is reduplicated one to several times but in each case there is a long portion intervening. The margin of the hydrophore is very little everted; hydranth large, with 12-14 tentacles.

Gonosome.—Male gonangia broadly club-shaped, with distinct pedicels arising in rows from the branches just at the point where the pedicels are given off.

Distribution.—Nanoose Bay, off West Rocks, Departure Bay, off Matia I.

This species seems to have got rather far afield as the nearest point at which it has been reported is off Patagonia but the resemblance to Allman's figures is so marked there can scarcely be any doubt that it is the same species.

Halecium halecinum (Linnaeus)

Pl. XX, Fig. 72

Sertularia halecina LINNÆUS., Syst. Nat. 1767, p. 1308.
Halecium halecinum FRASER, West Coast Hydroids, 1911, p. 47.

Trophosome.—Stem fascicled, erect, rigid; primary branches fascicled, few, long, running in the same direction as the main stem;

secondary branches arranged in a regular manner, and the pedicels are arranged pinnately on these; hydrophores tubular, with rim very little everted if at all.

Gonosome.—Gonangia borne in rows on the upper side of the branchlets; female gradually broadening distally, main portion truncated but one side projecting in the form of a small tube, through the aperture of which pass two hydranths; male gonangia oblong, tapering slightly toward the base.

Distribution.—Puget Sound (Nutting); Ucluelet (Fraser); Swiftsure Shoal.

Halecium kofoidi Torrey

Pl. XX, Fig. 73

Halecium kofoidi Torrey, Hyd. of the Pacific Coast, 1902, p. 49.
Halecium kofoidi Fraser, West Coast Hydroids, 1911, p. 47.

Trophosome.—"Colony with a thick trunk from which branches arise irregularly, forming a sparse tuft 1½ inches high. The branches may branch again; from these secondaries the ultimate branches grow, alternating regularly on each side of the branch. All branches are divided into internodes of approximately equal length. Each internode usually bears on its shoulder at its distal end a sessile hydrotheca which does not reach beyond the distal end of the internode. Within this hydrotheca another may arise on a short stalk, and within the latter, still another on a similar stalk. These stalks are somewhat constricted at the base, and bend away slightly from the stem. Occasionally a stalked hydrotheca arises directly from the internode without the interposition of a sessile hydrotheca. There may be one or two wavy annulations at its base. Secondary and ultimate branches arise from the bases of hydrothecæ. The wall of the hydrotheca is especially thickened, the interior contour in profile being convex, while the outer one is straight. There is a circle of bosses of variable number and arrangement around the inner surface of the wall". (Torrey).

Gonosome.—"Male gonothecæ present. When mature they are long, oval, smooth, three to four times as long as broad, each attached below a hydrotheca by a short pedicel, which may have one or two faint annulations. The base of the gonotheca may have a wavy outline. Small terminal aperture.

Color of stem and base of branches brown". (Torrey).

Distribution.—San Juan Archipelago. (Fraser).

I have no specimens of this species at hand now hence I have given Torrey's original description and his figures.

Halecium labrosum Alder

Pl. XX, Fig. 74

Halecium labrosum ALDER, Ann. and Mag. N.H., 3rd ser., 3, 1859, p. 354.

Halecium labrosum HINCKS, Br. Hydroid Zoophytes, 1868, p. 225.

Trophosome.—Stem fascicled, sparsely branched, primary branches fascicled, secondary branches pinnately arranged; these may branch again; the pedicels are borne singly or in pairs from the distal end of the internode; three or four annulations at the proximal end of the internodes of the branches and about the same number at the base of the pedicels, which are long and tubular; margin of hydrophore very distinctly everted; when reduplication takes place the tube between the hydrophores is long.

Gonosome.—Gonangia ovate, growing in rows on the upper surfaces of the branches, male and female more nearly alike than in other species of this genus.

Distribution.—North of Gabriola I., Dodds Narrows.

Halecium parvulum Bale

Pl. XXI, Fig. 75

Halecium parvulum BALE, Proc. Linn. Soc., N.S.W., 1888, p. 760.

Halecium gracile BALE, Proc. Linn. Soc., N.S.W., 1888, p. 759.

Halecium gracile CLARK, Mus. Comp. Zoll., Harvard, vol. XXV, No. 6, 1894, p. 74.

Halecium balei FRASER, West Coast Hydroids, 1911, p. 46.

Trophosome.—Stem and larger branches fascicled; main branches few and short; branches not numerous proximally but more so distally. In some cases near the tip of the branches there are many short branchlets or pedicels, so much so that it looks not unlike the tip of a branch of *H. densum* but the latter is stouter and more wavy. The proximal internodes are long but the distal are quite short, the nodes are oblique; occasionally the pedicel or the branchlet may be more or less annulated; margin of hydrotheca well everted.

Gonosome.—Female gonangia large, oval compressed; orifice large, terminal, ova large; male somewhat similar in shape, but much smaller; found growing directly from the branches, sometimes in the place of hydrophores.

Distribution.—San Juan Archipelago (Fraser); Rose Spit, Swiftsure Shoal, Hammond Bay, Dodds Narrows, Gabriola Pass, Porlier Pass, off Matia I., off Sucia Is., Ruxton Passage, Friday Harbor.

Bale described two specimens of *Halecium*, *H. gracile* and *H. parvulum*, which are probably the same species. *H. gracile*, the name

he first used, was preoccupied and on that account, in my West Coast paper, I suggested the name, *H. balei*. It would have been more correct to have used the name he used in the second place, *H. parvulum*, as it was not preoccupied. The correction is therefore made here.

Halecium pygmæum Fraser

Pl. XXI, Fig. 76

Halecium pygmæum FRASER, West Coast Hydroids, 1911, p. 48.

Trophosome.—Colony minute from a creeping stolon, with no continuous main stem; a single pedicel grows out from the stolon, giving rise to a hydrophore terminally; just below the hydrophore one or two pedicels may be given off, each turning upwards abruptly at the base; this may be repeated with the secondary pedicels until a series of 5 or 6 appears, but few of the colonies have so many; each pedicel has 1-3 annulations at the base; the hydrophore is tubular with the margin but little everted.

Gonosome.—Gonangia borne on the pedicels, similarly placed to the hydranth pedicels; the male is long almost cylindrical but tapering slightly to the distal end and more so to the proximal; the female is obovate, with an opening on the side but near the distal end, shaped like a half-moon; the ova are large, 6–8 in each gonangium. Usually the gonangium is much larger than the whole colony which bears it. In no case have I seen more than one gonangium on one colony.

Distribution.—San Juan Archipelago (Fraser); China Hat, Friday Harbor.

This species bears much resemblance to *Halecium speciosum* Nutting in its node of branching and in its general appearance but the gonangia are very much different. The resemblance to *Halecium nanum* Alder is also quite marked. In this case the male gonangium is somewhat similar in the two species although that of *H. nanum* is shorter and stouter than that of *H. pygmæum*. The female gonangia are different. Yet again it resembles *H. curvicaule* Lorenz, particularly the figures and description as given by Dons.[26] Here too, the male gonangia are similar but the female are not much so. The presence of the two hydranths as in the case of *H. nanum*, distinguish these gonangia from those of *H. pygmæum*. All of the species are quite minute.

Halecium reversum Nutting

Pl. XXI, Fig. 77

Halecium reversum NUTTING, Harriman Hydroids, 1901, p. 180.
Halecium reversum FRASER, West Coast Hydroids, 1911, p. 48.

[26] Hydroid Bemerkungen I, 1912, p. 61-70.

Trophosome.—Stem short, stout, fascicled; branches simple, arranged alternately, divided into internodes which are not annulated; each internode gives rise to a hydrophore from its proximal portion; pedicels vary much in length; hydrophore margin slightly everted.

Gonosome.—Unknown.

Distribution.—North of Gabriola I.

Halecium scutum Clark

Pl. XXI, Fig. 78

Halecium scutum CLARK, Alaskan Hydroids, 1876, p. 218.
Halecium scutum FRASER, 1911, p. 49.

Trophosome.—Stem stout, fascicled, much and irregularly branched; primary branches fascicled; ultimate branches much lighter in color; divided by more or less oblique nodes into short wedge-shaped internodes, each of which has one or two hydrophores varying somewhat in position from extreme distal end of the internode to some distance from it; hydrophores sessile, if reduplicated, the second sits quite close to the first; rather stout, very slightly everted.

Gonosome.—Gonangia obovate with an aperture projecting from the side near the distal end, although varying somewhat in position.

Distribution.—San Juan Archipelago (Fraser); Copalis Beach, Washington.

Halecium tenellum Hincks

Pl. XXI, Fig. 79

Halecium tenellum HINCKS, Ann. and Mag. N.H., 3rd ser., 8, 1861, p. 252.
Halecium tenellum FRASER, West Coast Hydroids, 1911, p. 49.

Trophosome.—Colony small, not over 15 mm. in height; stem delicate, sometimes annulated or wavy; irregularly branched; branches given off below the hydrophores, making almost a right angle with the stem; hydrophores strongly everted.

Gonosome.—"Gonangia oval or ovate, smooth, borne at the base of the branches or below the hydrophores." (Nutting).

Distribution.—San Juan Archipelago (Fraser); Rose Spit, Prince Rupert, Swiftsure Shoal, Hammond Bay, north of Gabriola I., Pylades Channel, Gabriola Pass, off Matia I.

No gonangia were obtained. Description and drawing are from Nutting.

Halecium washingtoni Nutting

Pl. XXII, Fig. 80

Halecium geniculatum NUTTING, Hyd. of Alaska and Puget Sound, 1899, p. 744.

Halecium washingtoni NUTTING, Am. Naturalist, XXXV, 1901, p. 789.
Halecium nuttingi TORREY, Hyd. of the Pacific Coast, 1902, p. 50.
Halecium washingtoni FRASER, West Coast Hydroids, 1911, p. 50.

Trophosome.—Stem and larger branches fascicled but not so stout as some of the other fascicled stems of this genus; primary branches irregular, secondary branches less so with an alternate arrangement; internodes long, annulated proximally with at least two, often more, annulations, these usually oblique; the ultimate branches are bent at the nodes to give a zigzag appearance; pedicels usually annulated at the base; hydrophores with rim everted, hydranths large.

Gonosome.—"Gonangia borne singly in the axils of the branches and branchlets, regularly ovoid in one view, barnacle-shaped in the other; aperture large, terminal. The appearance of some of them would indicate the possible presence of an acrocyst at a later stage of development" (Nutting).

Distribution.—Puget Sound (Nutting); Dodds Narrows, San Juan Archipelago (Fraser); Northumberland Channel, Gabriola Pass, Friday Harbor.

There were no gonangia on specimens obtained. The drawing and description are after Nutting's original.

Halecium wilsoni Calkins

Pl. XXII, Fig. 81

Halecium wilsoni CALKINS, Hyd. of Puget Sound, 1899, p. 343.
Halecium wilsoni FRASER, West Coast Hydroids, 1911, p. 49.

Trophosome.—Stem fascicled but slender and delicate; main branches few irregularly arranged; branchlets numerous, short and slender; the internodes are of uniform length, 1-3 annulations at each node; hydrophore with slightly everted margin.

Gonosome.—Male and female gonophores similar in shape but with the female smaller than the male, disk-shaped with the opening at the distal end; the blastostyle is very distinctly branched; the sporosacs are extruded into an acrocyst; irregularly situated near the base of the main branches of branchlets.

Distribution.—Bremerton (Calkins); Bare Island (Hartlaub); Ucluelet, San Juan Archipelago (Fraser); Clarke Rock, Nanoose Bay, north of Gabriola Island, Northumberland Channel, Gabriola Reefs, off Matia I., Friday Harbor.

Genus **OPHIODES**

Trophosome.—As in the family; tentacular organs present.

Gonosome.—Gonophores producing fixed sporosacs.

Ophiodes gracilis new species

Pl. XXII, Fig. 82

Trophosome.—Slender stems growing from a regular reticular stolon; the longer stems are very distinctly jointed and may be slightly branched. Besides these longer stems there are more numerous shorter ones, each of which serves as a pedicel of a hydrophore; they are not jointed but they are distinctly annulated; the margin of the hydrophore is but little everted, often not at all. Tentacular organs appear on the stolon as well as on the stem; they are very long and slender and are protected by a chitinous cap similar to a nematophore of the *Plumularidæ.*

Gonosome.—Unknown.

Distribution.—Clarke Rock, Pylades Channel, Rose Spit.

This species seems to be quite distinct from any of those of which I have seen figures. It bears as much resemblance to *O. mirabilis* Hincks as to any of the others but does not appear very much like it even.

Family **Lafœidæ**

Trophosome.—Hydrotheca tubular; margin entire, no operculum, hydranth with conical hypostome.

Gonosome.—Gonangia forming a coppinia mass.

I have some doubt as to the advisability of including the genus *Lictorella* in this family. Unlike the other genera it has a distinct diaphragm in the hydrothecal cavity. In other features the resemblance is marked. It has gonangia in a coppinia mass, which probably is the most characteristic feature of the *Lafœidæ.* As other investigators have included it in this family it is probably better to do so for the present at least.

Key to the genera of Lafœidæ found in the Vancouver I. region.

A. Hydrothecæ directly attached to a reticular stolon. . . . . *Filellum*

B. Hydrothecæ attached to a fascicled stem

  a. No septum present in the hydrothecal cavity

    1. Hydrothecæ free or very slightly adherent. . . . . . *Lafœa*

    2. Hydrothecæ largely adherent or immersed. . . *Grammaria*

  b. Septum present in hydrothecal cavity. . . . . *Lictorella*

Genus **FILELLUM**

Trophosome.—Stem a slender stolon, growing over other hydroids, wormtubes etc.; hydrothecæ partly adherent, the free portion curved upward; no diaphragm in the hydrothecal cavity.

Gonosome.—A coppinia mass.

In previous papers, under this genus I have reported a species, *F. expansum* Levinsen. At Woods Hole in the summer of 1911, I found what I took to be the coppinia mass of that species.[27] I had found specimens at various localities in the Atlantic and the Pacific. In some of these the animal was present in the tube but not expanded so as to appear at all without. When nearly filling the tube it has all the appearance of a hydroid even to its tentacles. I have never had the opportunity to section a specimen so expanded and evidently it will be necessary to do so. I had seen it placed among hydroids in a number of lists and no doubt arose as to its being a hydroid until Kramp's paper [28] came to hand when the New England paper was in course of preparation. Even with this before me, it seemed impossible to believe that it belonged to the Bryozoa. Broch had stated earlier [29] that it was probably a species of *Folliculina*, but I had overlooked the footnote containing the notice. Since the New England paper was published two papers by Dons,[30 & 31] bearing directly on the matter, have come to hand. The former was published previously but I had not seen it. Both Kramp and Dons have seen Levinsen's material and have obtained Levinsen's admission that the species is a *Folliculina*. The species they have worked out is undoubtedly the same species that is so abundant along the east and west coasts of North America. I have recently found many more specimens but they do not help to settle the question, since I have not seen any specimen with the zooid fully expanded. With such weight of evidence in favor of considering it a species of *Folliculina* it seems better to leave it out of the hydroid list, although I cannot say that I am yet satisfied. An explanation is still necessary for that which I have described as a coppinia mass. Nothing similar has been described unless it be the cytoplasmic masses of Dons.

Since the species seems to be quite common in the vicinity, it may still be possible to get material in such a condition that the doubt in the matter will be removed.

Filellum serpens (Hassall)

Pl. XXII, Fig. 83

Campanularia serpens HASSALL, Trans. Micr. Soc., 1852, p. 163.
Filellum serpens FRASER, West Coast Hydroids, 1911, p. 50.

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[27] New England Hydroids, 1912, p. 45.
[28] Report on the Hydroids from N. E. Greenland, 1911, p. 374.
[29] Die Hydroiden der Arktischen Meere, 1909, p. 160.
[30] Bemerkninger om Forveksling av Folliculina med Filellum, 1910.
[31] Folliculina Studien, I-III, 1912.

Trophosome.—Stolon reticular, creeping over other hydroids, wormtubes etc.; hydrothecæ adherent for from one-half to two-thirds of their length; nearly the same size throughout, not annulated but there may be some horizontal striæ near the margin; margin not flaring.

Gonosome.—Coppinia mass rather compact, the gonangia not placed so closely together as in other species; hydrothecal tubes long and slender.

Distribution.—San Juan Archipelago (Fraser); Nawhitti Bar, Hammond Bay, Departure Bay, Northumberland Channel, Friday Harbor.

Genus **GRAMMARIA**

Trophosome.—Stem fascicled, consisting of a hydrothecate axial tube surrounded by a certain number of peripheral, non-hydrothecate tubes; hydrothecæ partially adherent; no diaphragm in hydrothecal cavity.

Gonosome.—A Coppinia mass.

Key to the species of *Grammaria* found in the Vancouver I. region.

A. Large portion of hydrotheca free from the stem......*G. abietina*

B. Hydrothecæ almost wholly immersed................*G. immersa*

Grammaria abietina (Sars)

Pl. XXII, Fig. 84

Campanularia abietina Sars, Nyt. Mag. for Naturvid., 1851, p. 139.
Grammaria robusta Stimpson, Mar. Inv. of Grand Manan, 1854, p. 9.
Grammaria abietina Sars, Norske Hydroider, 1863, p. 34.
Salacia abietina Hincks, Br. Hydroid Zoophytes, 1868, p. 212.
Lafœa abietina Bonnevie, Norske Nordhavs-Exped., 1899, p. 64.
Grammaria abietina Fraser, Hydroids from Nova Scotia, 1913, p. 171.

Trophosome.—Stem very stout, irregularly branched, branches constricted at the base, resembling a main stem in all particulars; a large portion of the hydrotheca free, the free portion being directed outwards; orifice nearly circular, margin vertical.

Gonosome.—"Coppinia, generally of an irregular oval form. All the tubes extending radially from it bend at certain distance from the surface in all directions, thus forming a network lying like a capsule outside the cluster of gonangia" (Bonnevie).

Distribution.—Swiftsure Shoal, Departure Bay, Northumberland Channel, Friday Harbor.

I have not found the gonosome. The description and the figure are from Bonnevie.

Grammaria immersa Nutting

Pl. XXIII, Fig. 85

Grammaria immersa NUTTING, Harriman Hydroids, 1901, p. 176.
Grammaria immersa FRASER, West Coast Hydroids, 1911, p. 50.

Trophosome.—Stem stout but not so stout as that of *G. abietina*; branches given off at irregular intervals, forming nearly a right angle with the stem, constricted at the base; hydrothecæ so much immersed that only a short portion of the distal extremity shows; the free portion is nearly at right angles to the stem and the margin is vertical.

Gonosome.—(not previously described) Coppinia mass almost globular but slightly elongated in the direction of the stem; one mass measured 6 mm. in long and 4 mm. in transverse diameter, and that relation holds very nearly for all other masses examined; the hydrothecæ are long, slender and very numerous, much similar to those in some species of *Lafœa*.

Distribution.—Dodds Narrows (Fraser); off Lasqueti I., Northumberland Channel, Gabriola Reefs.

Genus **LAFŒA**

Trophosome.—Mature stems strongly fascicled and erect, young stems may be creeping; hydrothecæ, with but few exceptions, entirely free from the stem; no diaphragm in the hydrothecal cavity.

Gonosome.—A coppinia mass.

Key to the species of *Lafœa* found in the Vancouver I. region

A. Hydrothecæ sessile, sometimes slightly adherent at the base . . . . *L. dumosa*

B. Hydrothecæ pedicellate
   a. Pedicel making an angle of less than 45° with the stem . . . . *L. gracillima*
   b. Pedicel making an angle of more than 45° with the stem . . . . *L. fruticosa*

Lafœa dumosa (Fleming)

Pl. XXIII, Fig. 86

Sertularia dumosa FLEMING, Edin. Phil Jour., II, 1828, p. 83.
Lafœa dumosa FRASER, West Coast Hydroids, 1911, p. 51.

Trophosome.—Mature stem strongly fascicled, erect, coarse, much branched, branches also coarse; young stem either erect or creeping over other hydroids; hydrothecæ sessile but usually free from the stem, occasionally towards the distal part of the stem the hydrotheca is adherent; even when the base is free the proximal portion often passes

up in the same direction as the stem, the distal portion curving outward.

Gonosome.—The gonangia of the coppinia mass as seen from the surface are hexagonal with a projection containing the orifice at the centre; the elongated hydrothecæ come out at intervals among them.

Distribution.—Puget Sound (Nutting); Puget Sound (Torrey); Banks I., Departure Bay, Dodds Narrows, Ucluelet, Port Renfrew, San Juan Archipelago (Fraser); found almost everywhere that collections have been made from Queen Charlotte Is. to Puget Sound.

Lafœa fruticosa Sars

Pl. XXIV, Fig. 87

Lafœa fruticosa SARS, Norske Hydroider, 1862, p. 30.
Lafœa fruticosa FRASER, West Coast Hydroids, 1911, p. 52.

Trophosome.—Stem fascicled, with many large branches regularly arranged sometimes all on the one side of the stem; pedicels long, with 3 or 4 twists, passing out at an angle of more than 45° with the stem; hydrothecæ rather large with the lower side usually more nearly in line with the pedicel than the upper side; the margin is at right angles to the wall of the hydrotheca.

Gonosome.—"Coppinia with small irregular facets and tubes that are very long and thin and curved in a spiral like a watch-spring" (Bonnevie).

Distribution.—Puget Sound (Nutting); San Juan Archipelago (Fraser); off Cape Edenshaw, Swiftsure Shoal, north of Gabriola I., Gabriola Reefs.

Although it was in this species that Levinsen first found that the mass of gonangia belonged to the specimen to which it was attached and was not a distinct species of the genus *Coppinia*, I have not been able to find the coppinia. The description and the figure are taken from Bonnevie, who, perhaps better than any other other, has made clear the distinction between this species and *L. gracillima*.

The specimen I referred to in my West Coast paper as *L. grandis*, I now believe to be but *L. fruticosa* with larger hydrothecæ than is usual in the other specimens obtained.

Lafœa gracillima (Alder)

Pl. XXIV, Fig. 88

Campanularia gracillima ALDER, Trans. Tynes. F. C., 1857, p. 39.
Lafœa gracillima FRASER, West Coast Hydroids, 1911, p. 52.

Trophosome.—Stem fascicled, very much branched, but without the distinct main stem present in *L. dumosa* and *L. fruticosa*; the

young colonies often are creeping; hydrothecæ long, tubular, somewhat curved, with the convex side uppermost, smaller than those of the other species but varying much in size; pedicels with one or two slight twists, coming out from the stem at an angle less than 45°.

Gonosome.—The whole coppinia mass resembles that of *Lafœa dumosa* but the separate gonangia are not regularly hexagonal when viewed from the surface, they are more nearly circular and are not so regularly arranged; the hydrothecal tubes are more slender and perhaps longer.

Distribution.—Bare Island (Hartlaub); Puget Sound (Nutting); Puget Sound (Torrey); Departure Bay, Dodds Narrows, Ucluelet, Port Renfrew, San Juan Archipelago (Fraser); found almost everywhere where collections have been made from Queen Charlotte Is. to Puget Sound.

This species and *Lafœa dumosa* are particularly common in all dredged material in this region. In the one summer's dredging I have *L. gracillima* recorded from 23 distinct localities and *L. dumosa* from 24.

Genus **LICTORELLA**

Trophosome.—Stem fascicled, with ultimate branches monosiphonic and bilateral; hydrothecæ never sessile; diaphragm present in hydrothecal cavity; nematocysts may be present on the branch at the base of the hydrotheca.

Gonosome.—"Gonangia aggregated, with curious protuberant shoulders on one or two sides of the distal end. These are horn like processes which may curve upward, or downward, or be directed straight outward, according to the species" (Nutting).

Lictorella carolina Fraser

Pl. XXIV, Fig. 89

Lictorella carolina Fraser, West Coast Hydroids, 1911, p. 53.

Trophosome.—Stem fascicled, with few hydrothecæ; main branches also fascicled but tubes are reduced in number, gradually disappearing until in the secondary branches there is but a single tube. An appearance of dichotomy is produced in most cases by a hydrotheca on one tube originating in such a way that it seems to come from the axil formed by the branching of another tube. The ultimate branches are divided into internodes of almost equal length by deep constrictions; from each internode, nearly midway between the nodes, a single hydrotheca is given off. These hydrothecæ alternate on successive internodes but are all in the same plane; at the origin of each of these there is a distinct shoulder on the branch, which is

divided by a deep constriction from the base of the hydrotheca; on this shoulder there are two nematocysts present, which are deeply cup-shaped and are supported by a two-ringed pedicel. The hydrothecæ widen gradually and symetrically until the diaphragm is reached; from this point the under surface passes out almost in a straight line, while the upper surface is convex for some distance, after which it passes out parallel to the lower side; the margin is but slightly flaring, it is commonly duplicated.

Gonosome.—Unknown.

Distribution.—San Juan Archipelago (Fraser).

Family **Sertularidæ**

Trophosome.—Hydrothecæ sessile, usually arranged on both sides of the stem and branches, and more or less adnate to them.

Gonosome.—Gonophores producing fixed sporosacs, never free medusæ.

Key to the genera of the Sertularidæ found in the V.I. region

A. Hydrothecæ all on one side of the branches, their distal ends alternating to right and left................*Hydrallmania*

B. Hydrothecæ arranged in two longitudinal rows
  a. Hydrothecæ in opposite pairs................*Sertularia*
  b. Hydrothecæ alternate
    1. Operculum of one adcauline flap
      i. Hydrothecal aperture small, body flask-shaped.....................................*Abietinaria*
      ii. Hydrothecal aperture large, body not flask-shaped.....................................*Diphasia*
    2. Operculum abcauline or with more than one flap
      i. Operculum of 3 or 4 pieces...........*Sertularella*
      ii. Operculum of 1 or 2 pieces.............*Thuiaria*

C. Hydrothecæ arranged on all sides of the branches
  a. Operculum usually of one flap................*Selaginopsis*
  b. Operculum of several flaps.................*Dictyocladium*

Genus **ABIETINARIA**

Trophosome.—Hydrothecæ alternate, flask-shaped; aperture small; operculum with a single adcauline flap.

Gonosome.—Gonangia without spines or internal marsupium.

Key to the species of *Abietinaria* in the Vancouver I. region

A. Stem stout
  a. Gonangia with strong longitudinal crests

1. Primary branches usually unbranched.....*A. amphora*
2. Primary branches much branched........*A. turgida*

b. Gonangia smooth or annulated transversely
1. Hydrothecæ almost wholly immersed.....*A. gigantea*
2. One-fourth to one third of the hydrotheca free
   i. Margin vertical or nearly so............*A. rigida*
   ii. Margin nearly horizontal............*A. variabilis*
3. Much more than one-third of the hydrotheca free ....*A. abietina*

B. Stem slender
a. Hydrotheca with two distinct teeth.............*A. greenei*
b. Hydrothecæ without distinct teeth
1. Gonangium oval, smooth.................*A. filicula*
2. Gonangium top-shaped, transversely-annulated...... ....*A. anguina*
3. Gogangium oval, with longitudinal crests....*A. gracilis*
4. Gonangium oblong, smooth................*A. traski*

Abietinaria abietina (Linnæus)

Pl. XXV, Fig. 90

Sertularia abietina Linnæus, Syst. Nat., 1758, p. 808.
Abietinaria abietina Nutting, American Hydroids, pt. 2, 1904, p. 114.
Abietinaria anguina Nutting, Ibid., p. 119.
Abietinaria abietina Fraser, West Coast Hydroids, 1911, p. 59.

Trophosome.—Main stem stout, straight or slightly flexuous, divided into regular internodes; primary branches large, pinnately arranged, with three hydrothecæ between two successive branches on the same side of the stem. The primary branches are occasionally branched; they are divided into regular internodes. Hydrothecæ large, occasionally nearly opposite, large at the base, narrowing above to form a distinct neck and expanding again slightly to the round, smooth margin, which is horizontal but oblique as compared with the axis of the hydrotheca; a large portion of the hydrotheca, sometimes more than one-half, is free from the stem.

Gonosome.—Gonangia borne on the upper sides of branches, oval with a short collar and a wide aperture; surface smooth or slightly annulated.

Distribution.—Albatross collections off the State of Washington and off Vancouver Island (Nutting); San Juan Archipelago, Ucluelet, Dodds Narrows, Departure Bay, Banks I. (Fraser); very abundant from Queen Charlotte Is. to Puget Sound. The following localities have been noted: off C. Edenshaw, off Massett, China Hat, Swiftsure

Shoal, Clayuquot Sound, Alert Bay, Nanoose Bay, Departure Bay, north of Gabriola I., Northumberland Channel, Dodds Narrows, Pylades Channel, Gabriola Pass, Gabriola Reefs, Ruxton Passage, Whaleboat Passage, off Matia I., off O'Neale I., off Brown I., Friday Harbor, Upright Channel, San Juan Channel, Griffin Bay, off Shaw I., Deer Harbor, Port Townshend, Pt. Grenville.

Abietinaria amphora Nutting

Pl. XXV, Fig. 91

Abietinaria amphora NUTTING, American Hydroids, pt. 2, 1904, p. 119.
Abietinaria amphora FRASER, West Coast Hydroids, 1911, p. 58.

Trophosome.—Stem straight, with branches very regularly arranged, with three hydrothecæ between two successive branches on the same side; the portion near the base that is free from branches is also devoid of hydrothecæ; this portion is deeply annulated. The primary branches do not branch again, and seldom have noticeable nodes; hydrothecæ nearly opposite, swollen at the base and narrowing to a neck like those of *A. abietina* but they are not so large as these, about half free; margin entire.

Gonosome.—Gonangia borne on front of the stem and proximal portions of the branches, usually crowded together in two rows; very large, oval, with long neck and round terminal aperture, provided with 4 or 5 strong crests running longitudinally from the neck to the base.

Distribution.—Albatross Station 2866, N. 48° 09′, W. 125° 03′, 171 fathoms; Whidley Island, Puget Sound (Nutting); Port Renfrew, Ucluelet, Dodds Narrows (Fraser); Northumberland Channel, Pylades Channel, Gabriola Pass, Port Renfrew, Nawhitti Bar, Friday Harbor, San Juan Archipelago.

Abietinaria anguina (Trask)

Pl. XXV, Fig. 92

Sertularia anguina TRASK, Proc. Cal. Acad. Sc. 1857, p. 112.
Sertularia labrata MURRAY, Ann. and Mag. N.H., 3rd. ser. 5., 1860, p. 250.
Sertularia anguina CLARK, Hyd. of the Pacific Coast, 1876, p. 255.
Abietinaria labiata KIRCHENPAUER, Nordische Gattungen, 1884, p. 34.
Thuiaria coei NUTTING, Harriman Hydroids, 1901, p. 185.
Abietinaria coei NUTTING, American Hydroids, pt. 2, 1904, p. 117.
Abietinaria anguina FRASER, West Coast Hydroids, 1911, p. 58.

Trophosome.—Stem rather slender, strongly geniculate above the lowest branches, straight below these and annulated; branches regu-

larly pinnate, not branched again. One hydrotheca in the axil of each branch and two besides this on the stem between the branch and the one next it on the same side; hydrothecæ nearly opposite, of the *abietina* type but small; margin scarcely even, rather shovel-shaped.

Gonosome.—Gonangia growing from the upper side of branches, top-shaped with a distinct collar, annulated, annulations near together proximally but farther apart distally.

Distribution.—Vancouver Island (Dawson); Tledis Village near Susk, B.C., (Nutting); Port Renfrew, Ucluelet (Fraser); Hope Island, Nawhitti Bar.

This species is discussed at length in my West Coast paper.

Abietinaria filicula (Ellis and Solander)

Pl. XXV, Fig. 93

Sertularia filicula Ellis and Solander, Nat. Hist. Zooph., 1786, p. 57.
Abietinaria filicula Fraser, West Coast Hydroids, 1911, p. 60.

Trophosome.—Stem slender, straight in unbranched portion slightly flexuous in branched portion; branches regularly pinnate, often branched again and sometimes more than once. The main stem is divided into quite regular internodes but the branches have few if any nodes and these irregularly placed; hydrothecæ nearly opposite, shaped like those of *A. abietina* but much smaller.

Gonosome.—Gonangium oval, tapering into a narrow neck above and into a pedicel which is somewhat curved, below; surface smooth.

Distribution.—Albatross Station 2865, N. 48° 12′, W. 122° 49′ (Nutting); San Juan Archipelago, Victoria, Dodds Narrows (Fraser); Alert Bay, Departure Bay, Northumberland Channel, Gabriola Pass, Friday Harbor.

Abietinaria gigantea (Clark)

Pl. XXVI, Fig. 94

Thuiaria gigantea Clark, Alaskan Hydroids, 1876, p. 230.
Abietinaria gigantea Fraser, West Coast Hydroids, 1911, p. 60.

Trophosome.—Stem stout, with but few branches, these irregularly arranged and constricted at the base, similar in all respects to the main stem; nodes absent; hydrothecæ arranged alternately with but a short space of the stem between each pair; almost wholly immersed; regularly curved and almost the same size throughout; margin nearly vertical.

Gonosome.—Gonangia arranged in two rows on the surface of the stem, oval, with a distinct pedicel, smooth or slightly wrinkled, distal end truncate, sometimes oblique, without collar.

Distribution.—Albatross Station 3464, N. 48° 14′, W. 123° 20′40″ (Nutting).

I have not found this species in this region. The description and figures are from an Alaskan specimen.

Abietinaria gracilis Nutting

Pl. XXVI, Fig. 95

Abietinaria gracilis NUTTING, American Hydroids, pt. 2, 1904, p. 120.
Abietinaria gracilis FRASER, West Coast Hydroids, 1911, p. 61.

Trophosome.—Stem straggling, the portion that is branched somewhat geniculate; branching pinnate, not regular, branches varying in length so that the outline of the colony is irregular; hydrothecæ alternate or nearly opposite, distant, basal portion enlarged, narrowing gradually to a slender neck which expands to form the margin, this turned upward so as to be transverse to the axis of the branch. The whole hydrotheca is longer and more slender than others of this type.

Gonosome.—Gonangia borne on rows on upper side of branches, oval, narrowing above to form a short neck and below to form a short pedicel; longitudinal crests present, distinct but not very much raised.

Distribution.—Albatross Station 2873, N. 48° 30′, W. 124° 57′, 40 fathoms (Nutting); north of Gabriola I., Northumberland Channel.

Abietinaria greenei (Murray)

Pl. XXVI, Fig. 96

Sertularia greenei MURRAY, Ann. and Mag. N.H., 3d ser., 5, 1860, p. 121.
Abietinaria greenei FRASER, West Coast Hydroids, 1911, p. 61.

Trophosome.—Colony consisting of a dense cluster of slender, erect stems, which branch irregularly, the branches running in the same general direction as the stem and these as well as the main stem often branching dichotomously; the angle between the branch and the stem, even when the branching is dichotomous, is small and there is a constriction of the branch at the base; hydrothecæ alternate or more nearly opposite, more erect then in most of the other species of *Abietinaria;* the proximal half is all of about the same diameter, above which the hydrotheca narrows to form a neck which expands slightly to form the margin; two teeth are present on the abcauline side of the margin, these are usually very strongly marked but in some cases are scarcely noticeable.

Gonosome.—Gonangia borne in long rows on the front of branches, obconical with a small curved pedicel and a distinct collar which is tapering, aperture circular, surface regularly but not deeply corrugated. The sporosacs pass out of the gonangium into an acrocyst.

Distribution.—Port Renfrew, Vancouver I. (Nutting); San Juan Archipelago, Dodds Narrows, Departure Bay, Port Renfrew, Ucluelet (Fraser); Northumberland Channel, Pylades Channel, Gabriola Pass, Nawhitti Bar, Friday Harbor, Copalis, Pt. Grenville.

Abietinaria rigida Fraser

Pl. XXVI, Fig. 97

Abietinaria rigida Fraser, West Coast Hydroids, 1911, p. 61.

Trophosome.—Main stem stout, rigid, straight or but slightly flexuous with annulations at the base but very few nodes in the remainder of the stem; stems are found over 50 mm. in length that are entirely unbranched; branches with regular pinnate arrangement, making a wide angle with the stem and constricted at the base; like the stem they are rigid and brittle so that a colony is seldom found with all the branches complete. Hydrothecæ alternate, stout, narrowing gradually but slightly towards the circular opening, with no very distinct neck; the margin, which is even, lies parallel to the axis of the stem or branch; hydrothecæ well immersed, seldom more than one-fourth being free.

Gonosome.—Gonangia are borne on the upper surface of the branches, elongated oval, with a distinct pedicel, collar short but distinct, aperture large; surface smooth or very slightly wrinkled.

Distribution.—Albatross Station 2865, N. 48° 12′, W. 122° 51′, 48 fathoms (Nutting); San Juan Archipelago (Fraser); Nawhitti Bar, Departure Bay, off Matia I., of Waldron I., off O'Neale I., Friday Harbor, San Juan Channel, Upright Channel, Deer Harbor, Griffin Bay.

Abietinaria traski (Torrey)

Pl. XXVII, Fig. 98

Sertularia traski Torrey, Hyd. of the Pacific Coast, 1902, p. 69.
Abietinaria traski Fraser, West Coast Hydroids, 1911, p. 63.

Trophosome.—Stem long, straight, even in the younger colonies the proximal half is free from branches and in the older ones, the branched portion is relatively small as compared with the branched portion; branches very regularly pinnate, and graded so well in length that the colony is very symmetrical and graceful; although the stem

is a light horn color the branches are quite white. The nodes are not regular in the main stem and are absent, or nearly so, in the branches; hydrothecæ alternate, rather distant, short and thick with a short neck; margin not expanded, nearly circular but straight on the adcauline side.

Gonosome.—Gonangia arranged in rows on the face of the branches, oblong, without a distinct pedicel or collar; surface smooth.

Distribution.—Albatross Station 2861, N. 51° 14′, W. 129° 50′, 40 fathoms, Station 2873, N. 48° 30′, W. 124° 57′, 40 fathoms (Nutting); San Juan Archipelago, Dodds Narrows, Departure Bay (Fraser); China Hat, Clayuquot Sound, Swiftsure Shoal, off Lasqueti I., Nanoose Bay, off Clarke Rock, Departure Bay, north of Gabriola I., Northumberland Channel, Dodds Narrows, Gabriola Reefs, Whaleboat Passage, off Matia I., off Waldron I., off O'Neale I., off Brown I., Upright Channel, Griffin Bay, Deer Harbor, Port Townshend, Puget Sound.

Abietinaria turgida (Clark)

Pl. XXVII, Fig. 99

Thuiaria turgida CLARK, Alaskan Hydroids, 1876, p. 229.
Abietinara turgida FRASER, West Coast Hydroids, 1911, p. 63.

Trophosome.—Stem straight stout, distal portion branched; branches irregularly pinnate, constricted at the base, similar to the main stem; branched again either alternately or dichotomously; internodes on main stem short, on branches long; hydrothecæ nearly opposite, crowded, tubular, with a very slight narrowing distally, almost wholly immersed; margin entire, circular at right angles to the hydrotheca.

Gonosome.—Gonangia crowded on the stem and proximal portion of the branches, large, oval, with a short collar, aperture small, pedicel short; distinct longitudinal crests present.

Distribution.—Gabriola Pass, off Matia I., Port Townshend.

Abietinaria variabilis (Clark)

Pl. XXVII, Fig. 100

Sertularia variabilis CLARK, Alaskan Hydroids, 1876, P. 221.
Abietinaria variabilis FRASER, West Coast Hydroids, 1911, p. 63.

Trophosome.—Stem stout, straight or slightly flexuous; branches regularly alternate, stout and long, constricted at the base; hydrothecæ alternate, much the same size for the proximal two-thirds or three-fourths which is immersed and then narrowing suddenly to form a short neck, the margin very little flaring, oblique relatively to the stem but nearly horizontal.

Gonosome.—Gonangia borne on the upper sides of the branches, obovate, without collar, aperture large, surface smooth.

Distribution.—Albatross Station 2864, N. 48° 22′, W. 122° 51′, 40 fathoms, Station 2866, N. 48° 09′, W. 125° 03′, 171 fathoms, Station 3465 N. 48° 21′, W. 123° 14′, 48 fathoms, Puget Sound (Nutting); Queen Charlotte Is., (Fraser); off C. Edenshaw, off Massett, off Rose Spit; Swiftsure Shoal, Friday Harbor.

Genus **DICTYOCLADIUM**

Trophosome.—"Colony flabellate in form. Branches anastomosing and forming a widely reticulate structure or network. Hydrothecæ on more than two sides of the stem. Aperture without conspicuous teeth, operculum variable" (Nutting).

Gonosome.—"Gonangia borne in the bifurcations of the branches and marked with annular rugosites" (Nutting).

Dictyocladium flabellum Nutting

Pl. XXVII, Fig. 101

Dictyocladium flabellum NUTTING, American Hydroids, pt. 2, 1904, p. 105.

Dictyocladium flabellum FRASER, West Coast Hydroids, 1911, p. 63.

Trophosome.—"Colony flabellate in form, attaining a height of about 4 inches and branching in a strictly dichotomous manner; few evident internodes on stem or branches; the only annulations or constrictions ordinarily being those at the origin of branches or branchlets. Branches straight not flexuose, themselves dichotomously branching in the same plane, the ultimate branches often anastomosing with other branches, forming a rude reticulate pattern. Hydrothecæ arranged in four longitudinal series on stem and branches, so as to form an ascending spiral, tubular, about the distal one-third free, curved gently outward, margin irregular, but usually with a quadrilateral outline, with the corners of the outline very slightly if at all produced into four very low, obscure teeth; operculum with four flaps" (Nutting).

Gonosome.—"Gonangia borne in bifurcations of the branches, very large, ovate, body with shallow, broad, obscure annulations; neck in the form of a long truncated cone, with a round terminal aperture" (Nutting).

Distribution.—Albatross Station 2874, N. 48° 30′, W. 124° 57′, 27 fathoms (Nutting).

I have no specimens of this species. The description and the figures are from Nutting.

Genus DIPHASIA

Trophosome.—Hydrothecæ in two rows on the stem and branches; operculum of a single adcauline flap.

Gonosome.—Gonangia marked with spines or lobes, an internal marsupium usually present in the female.

Specimens described in my West Coast paper as *Diphasia claræ* have turned out to be young specimens of *Hydrallmania distans* Nutting.

Diphasia pulchra Nutting

Pl. XXVIII, Fig. 102

Diphasia pulchra NUTTING, American Hydroids, pt. 2, 1904, p. 111.
Diphasia pulchra FRASER, West Coast Hydroids, 1911, p. 64.

Trophosome.—Stem slender, somewhat geniculate distally; branches spirally arranged forming a dense bushy tuft, not unlike that of *Thuiaria argentea;* hydrothecæ alternate, rather distant, long pitcher-shaped, slender; margin with two broad teeth, opposite to each other.

Gonosome.—I believe the gonosome has not been described and I have no specimens with gonangia but I have seen some collected by Levinsen that have gonangia with an internal marsupium. He will probably give a description later.

Distribution.—Albatross Station 2863, N. 48° 58′, W. 123° 10′, 67 fathoms (Nutting).

Genus HYDRALLMANIA

Trophosome.—Hydrothecæ in groups on the side of the stem or branches, their bases in line but the distal ends turned alternately to right and left. Operculum of a single adcauline flap.

Gonosome.—Gonangia without spines or internal marsupium.

Hydrallmania distans Nutting

Pl. XXVIII, Fig. 103

Hydrallmania distans NUTTING, Hyd. from Alaska and Puget Sound, 1899, p. 746.
Hydrallmania distans FRASER, West Coast Hydroids, 1911, p. 65.

Trophosome.—Stem erect with a large proximal portion free of branches; branching much varied, often distinctly bilateral but at times with branches coming off in all planes. When the colony is bilateral the branches are regularly pinnate and unbranched making the colony look trim, but when the branches come off in all planes,

these branches are often branched alternately or dichotomously to give a very shaggy appearance. Hydrothecæ inserted with their bases in line and their distal ends alternately turned to right and left but this feature is not so noticeable in the younger specimens, the alignment may be so much out that it does not give the characteristic appearance of the adult at all. The length of the internode is not definite, the number of hydrothecæ on each varying from 3 upwards; hydrothecæ tubular with the distal end pitcher-shaped like that of a *Diphasia* and like these also with operculum of one adcauline flap.

Gonosome.—Gonangia borne on front of branches sometimes forming a definite row, oval or obovate with short neck, wide aperture and distinct pedicel; surface smooth.

Distribution.—Puget Sound (Calkins); Puget Sound (Nutting); San Juan Archipelago, Ucluelet, Dodds Narrows, Queen Charlotte Is., (Fraser); Rose Spit, Alert Bay, Claninnick, Clayuquot Sound, off Lasqueti I., Nanoose Bay, Hammond Bay, Departure Bay, off Snake I., north of Gabriola I., off Proctection I., Northumberland Channel, Pylades Channel, Gabriola Pass, Gabriola Reefs, Whaleboat Passage, off Matia I., Friday Harbor, off Brown I., off Waldron I., off O'Neale I., Upright Channel, off Shaw I., Griffin Bay, Port Townshend.

Genus **SELAGINOPSIS**

Trophosome.—Hydrothecæ arranged in more than two rows or longitudinal series at least on the branches; operculum usually of a single abcauline flap.

Gonosome.—Gonangia oval or obovate, usually smooth or nearly so.

Key to the species of *Selaginopsis* found in the Vancouver I. region

A. Hydrothecæ in 3 longitudinal series............. *S. triserialis*

B. Hydrothecæ in 4 longitudinal series

  a. Hydrothecæ in each series with the distal ends as well as the bases in a straight line.................. *S. pinnata*

  b. Hydrothecæ in a series with distal ends turned alternately to right and left......................... *S. hartlaubi*

C. Hydrothecæ in 6 longitudinal series at least on the distal portion of the branches

  a. Hydrothecæ in 4 series on proximal part and 6 rows on distal part of branches; hydrothecæ almost wholly immersed .... *S. cylindrica*

  b. Hydrothecæ in 6 series throughout; distal portion free .... *S. mirabilis*

Selaginopsis cylindrica (Clark)

Pl. XXVIII, Fig. 104

Thuiaria cylindrica CLARK, Alaskan Hydroids, 1876, p. 226.
Selaginopsis cylindrica NUTTING, American Hydroids, pt. 2, 1904, p. 131.
Selaginopsis plumiformis NUTTING, Ibid., p. 129.
Selaginopsis cylindrica FRASER, West Coast Hydroids, 1911, p. 65.
Selaginopsis plumiformis FRASER, Ibid., p. 67.

Trophosome.—Stem rather stout but more so distally than proximately, this is also true of the branches; branches regularly alternate and graded in such a way as to give a plumose appearance to the colony; sometimes the branches are curved or spirally twisted and have secondary branches to such an extent as to make the colony look bushy. In older colonies the main stem often becomes quite woody and some of the primary branches become so large that they look like main stems, with pinnate branching in the same way. Hydrothecæ tubular, almost wholly immersed, arranged in two series on the main stem, 4 series on the proximal portions of the branches and 6 series on the distal portions, the two extra series being intercalated at the same time, often quite near the base; aperture oval; margin entire; operculum of one abcauline flap.

Gonosome.—Unknown.

Distribution.—Puget Sound (Calkins); San Juan Archipelago, Queen Charlotte Is. (Fraser); off C. Edenshaw, off Massett, Rose Spit, Departure Bay, off Matia I., off O'Neale I., San Juan Channel, Friday Harbor, Griffin Bay, Deer Harbor.

In my West Coast paper I expressed a doubt whether *Selaginopsis plumiformis* was a species different from *S. cylindrica*. Since then I have found many specimens of *S. cylindrica* with the large branches just as described for *S. plumiformis* and I am satisfied that the two are the same species.

Selaginopsis hartlaubi Nutting

Pl. XXVIII, Fig. 105

Selaginopsis hartlaubi NUTTING, American Hydroids, pt. 2, 1904, p. 133.
Selaginopsis hartlaubi FRASER, West Coast Hydroids, 1911, p. 66.

Trophosome.—Stem stout, irregularly branched, branches varying very much in length, almost as stout as the main stem, not branched again; hydrothecæ in two regular series on the stem but in four series on the branches; in each series on the branches, the distal ends of the hydrothecæ turn to right and left alternately and the bases are

seldom perfectly in line; hydrothecæ immersed, tubular, with distal ends constricted; margin entire, oval; operculum of one abcauline flap.

Gonosome.—Unknown.

Distribution.—San Juan Archipelago (Fraser); off O'Neale I.

Selaginopsis mirabilis (Verrill)

Pl. XXVIII. Fig, 106

Diphasia mirabilis VERRILL, Amer. Jour. Sc., 3d. sev., V. 1872, p. 9.
Selaginopsis mirabilis FRASER, West Coast Hydroids, 1911, p. 66.

Trophosome.—Stem stout with regular pinnate branching, slightly geniculate in the branched portion; hydrothecæ in two rows on the stem but in six rows on the branches, distal portion of the hydrotheca free and turned out from the stem; margin oval, with two lateral teeth; operculum of two flaps.

Gonosome.—Gonangia oval, not constricted to form a distinct neck; aperture large, circular; surface smooth; a distinct pedicel is present.

Distribution.—Puget Sound, Albatross Station 2865, N. 48° 12′, W. 122° 49′, 40 fathoms (Nutting); San Juan Archipelago, Dodds Narrows, (Fraser); off Massett, Northumberland Channel, Pylades Channel, Gabriola Pass, Ruxton Passage, off Matia I., Friday Harbor, off Brown I. Deer Harbor, Upright Channel, Griffin Bay, off Waldron I., off O'Neale I., off Blakely I., Puget Sound.

Selaginopsis pinnata Mereschkowsky

Pl. XXVIII, Fig. 107

Selaginopsis pinnata MERESCHKOWSKY, Ann. and Mag. N.H., 5th. ser., 2, 1878, p. 436.
Selaginopsis pinnata FRASER, West Coast Hydroids, 1911, p. 66.

Trophosome.—Stem stout, woody, with deeply cut nodes; branches not regularly alternate; they vary from alternate to opposite; hydrothecæ in two rows on the stem and four very regular rows on the branches, not so closely crowded as in some of the other species, tubular but short and stout, with oval aperture; operculum of one abcauline flap.

Gonosome.—Unknown.

Distribution.—San Juan Archipelago, Queen Charlotte Is. (Fraser); off Rose Spit, Alert Bay.

Selaginopsis triserialis Mereschkowsky

Pl. XXIX, Fig. 108

Selaginopsis triserialis MERESCHKOWSKY, Ann. and Mag. N.H., 5th. ser., 2 1878, p. 435.
Sertularia incongrua TORREY, Hyd. of the Pacific Coast, 1902, p. 69.
Selaginopsis triserialis FRASER, West Coast Hydroids, 1911, p. 67.

Trophosome.—Stem rather slender for the genus, reaching a height of 30 cm., with long branches arranged alternately but not regularly; hydrothecæ in two rows on the stem and sometimes also on the proximal portions of the branches but in three rows in the distal portions; more distant than in other species of the genus; almost wholly immersed; aperture oval; operculum a single abcauline flap.

Gonosome.—"Gonangium oblong-oval in shape, with a large terminal aperture" (Nutting).

Distribution.—Nanoose Bay, off Waldron I.

I have not found the gonangium. Nutting found "a single distorted gonangium" and described it but did not figure it.

Genus SERTULARELLA

Trophosome.—Hydrothecæ in two rows, alternate, usually with 3 or 4 teeth and an operculum with 3 or 4 flaps.

Gonosome.—Gonangia usually supplied with ridges or corrugations.

Key to the species of *Sertularella* found in the Vancouver I. region.

A. Hydrothecæ with four teeth.
  a. Hydrothecæ wholly immersed . . . . *S. albida.*
  b. Hydrothecæ partly free.
    1. Hydrothecæ without annulations or rugosities . . . . *S. polyzonias*
    2. Hydrothecæ annulated or rugose.
      i. Stem slender, hydrothecæ distant . . . . *S. tenella*
      ii. Hydrothecæ decidedly rugose. . . . . *S. rugosa*
      iii. Hydrothecæ not large, more than half free . . *S. conica*
      iv. Hydrothecæ large, scarcely immersed . . . . . *S. tanneri*

B. Hydrothecæ with three teeth
  a. Stem erect, stout, hydrothecæ usually smooth . . . . . . *S. turgida*
  b. Stem erect, hydrothecæ annulated . . . . *S. pedrensis*
  c. Stem flabellate, gonangia contorted . . . . *S. pinnata*
  d. Stem lax, hydrothecæ smooth . . . . *S. tricuspidata*

Sertularella albida Kirchenpauer

Pl. XXIX, Fig. 109

Sertularella albida KIRCHENPAUER, Nordische Gattungen, 1884. p. 42.

Sertularella albida FRASER, West Coast Hydroids, 1911, p. 68.

Trophosome.—Stem stout, branching irregular but tending to be alternate; branches often branched again and as they are not uniform, the whole colony has a ragged, spreading appearance; nodes in both stem and branches deeply cut but irregularly placed; hydrothecæ tubular, curved slightly on the adcauline side and having a distinct bend on the abcauline side, placed closely together and wholly immersed or nearly so; margin with four teeth that are not very conspicuous; operculum with four flaps.

Gonosome.—"Gonangia axillary, very large, perhaps the largest found in the genus, ovate, regularly and closely annulated, with short, tubular neck and round terminal aperture." (Nutting).

Distribution.—Off Matia I., off Waldron I.

I have no specimens with gonangia. The description and the figure are from Nutting.

Sertularella conica Allman

Pl. XXIX, Fig. 110

Sertularella conica ALLMAN, Hydroids of the Gulf Stream, 1877, p. 21.

Sertularella conica FRASER, West Coast Hydroids, 1911, p. 68.

Trophosome.—Colony small, either unbranched or with a few short branches, which are like the main stem; hydrothecæ alternate, rather distant, free for about two-thirds of their length, nearly tubular but with the proximal end slightly swollen and the distal end narrowing to some extent, an appearance of annulations but these only on the adcauline side of the hydrothecæ; margin with four teeth; operculum with four flaps.

Gonosome.—Gonangia on the stem or on the stolon, oval, without distinct pedicel or neck; margin provided with four stout teeth, that may be straight as in *S. polyzonias*, or may be curved inward so as to almost meet above the centre of the aperture; surface rugose with distinct crests on the rugosities.

Distribution.—Townshend Harbor (Calkins); San Juan Archipelago, Port Renfrew, Ucluelet (Fraser); Northumberland Channel Dodds Narrows, Gabriola Pass, Friday Harbor, Swiftsure Shoal, Claninnick.

Sertularella pedrensis Torrey

Pl. XXIX, Fig. 111

Sertularella pedrensis TORREY, Hydroids of San Diego, 1904, p. 27.
Sertularella pedrensis FRASER, West Coast Hydroids, 1911, p. 70.

Trophosome.—Colony small, stem with occasional small branches or unbranched, divided into rather regular internodes, each of which bears one hydrotheca; hydrothecæ alternate, free for over half of their length, narrowing distally; margin with three teeth; operculum with three flaps; surface annulated, annulations most noticeable on the adcauline side. As Torrey points out, it bears much resemblance to *S. conica* but has three teeth instead of four.

Gonosome.—"Gonangia ovate, covered thickly and completely with slender spines." (Torrey).

Distribution.—Prince Rupert, off Clark Rock.

I have not seen the gonangia. The description and the figure are from Torrey.

Sertularella pinnata Clark

Pl. XXX, Fig. 112

Sertularella pinnata CLARK, Alaskan Hydroids, 1876, p. 226.
Sertularella pinnata FRASER, West Coast Hydroids, 1911, p. 70.

Trophosome.—Colonies small but usually growing in dense masses; main stem is divided into short internodes, each of which bears a branch with a hydrotheca in the axil, the branches arranged alternately; the branches often branch again sometimes dichotomously, giving a flabellate appearance to the whole colony; branches divided into short internodes, each of which bears a hydrotheca; the nodes are deeply cut and besides these there are often extra constrictions both on the branch and the hydrotheca; hydrothecæ inclined forward and outward so as to appear to be on the front of the stem, distal half or more free; hydrothecæ tubular, with a tendency to expansion at the margin; margin with three sharp, strongly marked teeth, two being larger than the third; operculum of three flaps.

Gonosome.—Gonangia borne in two rows on the front of the main stem and branches, oval, strongly rugose, much distorted; collar small, short; aperture circular.

Distribution.—San Juan Archipelago (Fraser); Departure Bay, Northumberland Channel, Dodds Narrows, Pylades Channel, Friday Harbor, Copalis.

Sertularella polyzonias (Linnæus)

Pl. XXX, Fig. 113

Sertularia polyzonias Linnæus, Syst. Nat., 1758, p. 813.
Sertularella polyzonias Fraser, West Coast Hydroids, 1911, p. 70.

Trophosome.—Stem rather slender; branching very irregular with a tendency to be alternate, branches long and like the stem flexuous; the branches may be unbranched or may branch extensively; nodes often appear at regular intervals, each internode bearing a hydrotheca; hydrothecæ alternate, rather distant, large, tapering but slightly towards the distal end, the distal half or more free; margin with four teeth that are not very distinct; operculum of four flaps.

Gonosome.—Gonangia large, oval; margin with four distinct, stout spines or teeth; surface strongly and regularly rugose.

Distribution.—San Juan Archipelago (Fraser); Clayuquot Sound, Dodds Narrows, Gabriola Pass, off Matia I., off Waldron I., Friday Harbor.

Sertularella rugosa (Linnæus)

Pl. XXX, Fig. 114

Sertularia rugosa Linnæus, Syst. Nat. 1758, p. 809.
Sertularella rugosa Fraser, West Coast Hydroids, 1911, p. 70.

Trophosome.—Colony small; stems usually unbranched, divided into regular internodes, each of which bears a hydrotheca; besides the regular nodes there are several other annulations or constrictions in the stem; hydrothecæ alternate, rather distant, fusiform, distinctly and markedly rugose, but the distal fourth or more is smooth; margin with four teeth, not very strongly marked; operculum with four flaps.

Gonosome.—Gonangia oval, rugose; margin with four teeth.

Distribution.—Puget Sound (Nutting); Dodds Narrows, Gabriola Pass, Friday Harbor.

Sertularella tanneri Nutting

Pl. XXX, Fig. 115

Sertularella tanneri Nutting, American Hydroids, pt. 2, 1904, p. 81.
Sertularella tanneri Fraser, West Coast Hydroids, 1911, p. 70.

Trophosome.—Stem rather slender, not rigid, branching irregularly, the branches having the same appearance as the main stem; stem and branches divided into regular internodes by oblique nodes, above which are annular depressions of the stem; hydrothecæ alternate,

distant, tubular but narrowed distally, scarcely immersed; margin with four low teeth; operculum of four flaps; surface annulated.

Gonosome.—Unknown.

Distribution.—Albatross Station 2873, N. 48° 30′, W. 124° 57′, 40 fathoms (Nutting); Swiftsure Shoal.

Sertularella tenella (Alder)

Pl. XXXI, Fig. 116

Sertularia tenella ALDER, Cat. Zooph. Northumberland, 1857, p. 23.
Sertularella tenella FRASER, West Coast Hydroids, 1911, p. 71.

Trophosome.—Colony small; branches usually absent, when present like the main stem; stem slender, geniculate, divided into regular internodes; hydrothecæ alternate, one to each node, very distant, scarcely immersed, fusiform, annulated with the neck smooth; margin with four teeth; operculum with four flaps.

Gonosome.—"Gonangia ovate, slender, ringed transversely, produced above into a short tubular orifice" (Hincks).

Distribution.—Albatross Station 2865, N. 48° 12′, W. 122° 49′, 40 fathoms (Nutting); Puget Sound (Hartlaub); San Juan Archipelago (Fraser); off Masett, China Hat, Alert Bay, Nanoose Bay, Departure Bay, north of Gabriola I., off Protection I., Northumberland Channel, Dodds Narrows, off Matia I., Friday Harbor, Swiftsure Shoal, Nawhitti Bar.

Description of gonosome and figure are taken from Hincks.

Sertularella tricuspidata (Alder)

Pl. XXXI, Fig. 117

Sertularia tricuspidata ALDER, Ann. and Mag. N.H., 2nd. ser. 18, 1856, p. 356.
Sertularella dentifera TORREY, Hyd. of the Pacific Coast, 1902, p. 61.
Sertularella dentifera FRASER, West Coast Hydroids, 1911, p. 69.
Sertularella tricuspidata FRASER, Ibid., p. 71.

Trophosome.—Stem slender, lax; branching irregularly, usually alternate but sometimes dichotomous; stem and branches divided into regular internodes, with one hydrotheca or a branch and a hydrotheca on each; hydrothecæ alternate, distinct, very slightly immersed, tubular, sometimes curved; margin with three distinct teeth; operculum of three flaps; occasionally the hydrothecæ are very much prolonged and the margin is reduplicated.

Gonosome.—Gonangia numerous on stem and branches, oval, with very strongly crested rugosities; a small tubular neck bears the circular aperture.

Distribution.—Puget Sound (Nutting); Port Townshend (Calkins); Albatross Station 2865, N. 48° 12′, W. 122° 49′, 40 fathoms, Station 2866, N. 48° 09′, W. 125° 03′, 171 fathoms (Nutting); San Juan Archipelago, Dodds Narrows, Departure Bay (Fraser); almost everywhere in the region in dredged material.

I do not think there is any doubt that *Sertularella dentifera* Torrey is the same as *S. tricuspidata*.

Sertularella turgida (Trask)

Pl. XXXI, Fig. 118

Sertularia turgida Trask, Proc. Cal. Acad. Sc., 1857, p. 113.
Sertularella turgida Fraser, West Coast Hydroids, 1911, p. 71.

Trophosome.—Colony small; stem stout, either unbranched or with a few irregularly placed branches that are similar to the main stem; hydrothecæ alternate, rather distant, nearly tubular but somewhat swollen at the base, more than one-half free; margin with three teeth; two of which are stronger than the third; operculum of three flaps; surface usually smooth.

Gonosome.—Gonangia borne in a row in the axils of the hydrothecæ, large, elongated oval; margin with three or four spines; spines also present in varying numbers on the distal portion of the surface which is not annulated.

Distribution.—Vancouver I. (Clark); Townshend Harbor (Calkins); San Juan Archipelago, Victoria, Port Renfrew, Ucluelet, Dodds Narrows, Departure Bay (Fraser); Nawhitti Bar, Clayuquot Sound, off Lasqueti I., Nanoose Bay, Northumberland Channel, Pylades Channel, Gabriola Pass, Gabriola Reefs, Porlier Pass, off Matia I. Upright Channel, Friday Harbor, off Brown I., Port Townshend, Coupeville.

Genus **SERTULARIA**

Trophosome.—Hydrothecæ in two rows, occurring in pairs which are strictly opposite throughout or at least on the distal portion of the branches.

Gonosome.—Gonangia oval or ovate, usually smooth.

Sertularia furcata Trask

Pl. XXXI, Fig. 119

Sertularia furcata Trask, Proc. Cal. Acad. Sc., 1857, p. 112.
Sertularia furcata Fraser, West Coast Hydroids, 1911, p. 72.

Trophosome.—Colony small; stems often in dense masses growing from stolons that are attached to eel-grass, slender, unbranched or with few small branches; hydrothecæ strictly opposite, each pair unless two or three near the base, adnate on one side of the stem but some distance apart on the other; they are tubular but somewhat curved and directed well outward, about one-third free; margin with two strong teeth, one of which is usually longer than the other.

Gonosome.—Gonangia borne on the lower portion of the stem just below the hydrothecæ; they are large, oval, somewhat compressed, with a short but distinct collar and large aperture; pedicel short and curved; surface smooth or very slightly wrinkled.

Distribution.—Ucluelet (Fraser); Clayuquot Sound, Pt. Grenville,

Genus **THUIARIA**

Trophosome.—Hydrothecæ in two rows on stem and branches; not in opposite pairs; hydrothecæ with not more than two teeth, operculum of one abcauline flap or two flaps (*T. thuiarioides* has an operculum of one adcauline flap.)

Gonosome.—Gonangia smooth or with two spines on the shoulders.

Key to the species of *Thuiaria* found in the Vancouver I. region.

A. Branches only on two sides of the stem
   a. Hydrothecæ strictly alternate
      1. Hydrothecæ close.......................... *T. alba*
      2. Hydrothecæ distant....................... *T. distans*
   b. Hydrothecæ nearly opposite
      1. Branches in the same plane as the stem...... *T. similis*
      2. Branches twisted at the base into a plane at right angles to the stem............................ *T. dalli*
B. Branches on all sides of the stem
   a. Distal branches forming a dense tuft
      1. Hydrothecæ nearly opposite.............. *T. fabricii*
      2. Hydrothecæ strictly alternate..
         i. Branches stiff; hydrothecæ almost wholly immersed .... *T. thuja*
         ii. Branches not stiff
            a. Operculum of one abcauline flap or two flaps...................... *T. robusta*
            aa. Operculum of one adcauline flap...... .... *T. thuiarioides*
   b. Branches on the distal portion of the stem loosely arranged
      1. Hydrothecæ more than half free............ *T. tenera*
      2. Hydrothecæ less than half free........... *T. argentea*

Thuiaria alba Fraser

Pl. XXXII, Fig. 120

Thuiaria alba FRASER, West Coast Hydroids, 1911, p. 74.

Trophosome.—Stem stout, rigid, with several annulations near the base; nodes irregular but distinct; branching regularly pinnate and alternate; the branches are not nearly so stout as the main stem, they are silvery white, while the main stem is much darker, a light horn color; the hydrothecæ are closely crowded, especially on the branches, so much so that in many instances the upper point where the hydrotheca leaves the branch is level with the base of the next hydrotheca in order; those on the two sides alternate regularly, they are tubular, curved so that the margin is nearly vertical, almost wholly immersed; operculum of one abcauline flap.

Gonosome.—(not previously described) Gonangia in two crowded rows on the front of the branches, oval or oblong, with a very short collar; no spines present; there are small annulations in the form of fine lines running transversely.

Distribution.—San Juan Archipelago (Fraser); Alert Bay, Friday Harbor, off O'Neale I., San Juan Channel, Upright Channel, off Brown I., Port Townsend, Griffin Bay.

Thuiaria argentea (Linnæus)

Pl. XXXII, Fig. 121

Sertularia argentea LINNÆUS, Syst. Nat., 1758, p. 809.
Thuiaria argentea FRASER, West Coast Hydroids, 1911, p. 75.

Trophosome.—Colonies often growing in clusters, stems slender; branches arise from all sides of the stem but are somewhat scattered, these branch dichotomously but regularly to produce a graceful colony; the silvery appearance adds to the effect; nodes distant; hydrothecæ generally alternate but occasionally nearly opposite, rather distant, curved gradually outward, usually about one-third free; margin with two teeth one often longer than the other; operculum of two flaps.

Gonosome.—Gonangia borne on the branches at the base of the hydrothecæ, tapering gradually from distal end to proximal, usually with two marked spines; collar short; opening rather large.

Distribution.—San Juan Archipelago, Queen Charlotte Is. (Fraser); Rose Spit, China Hat, north of Gabriola I., Northumberland Channel, Gabriola Reefs, off Matia I., off Waldron I., off Shaw I., Friday Harbor, Pacific Beach.

Thuiaria dalli Nutting

Pl. XXXII, Fig. 122

Sertularia cupressoides CLARK, Alaskan Hydroids, 1876, p. 220.
Thuiaria dalli NUTTING, American Hydroids, pt. 2, 1904, p, 68.
Thuiaria dalli FRASER, West Coast Hydroids, 1911, p. 75.

Trophosome.—Stem rather stout, branching regularly; branches alternately arranged, characterized by the fact that they are twisted at the base to be in a plane at right angles to the stem; each is supported on a projection from the stem, consisting usually of two or more joints; hydrothecæ nearly opposite, closely placed, almost wholly immersed, margin with two teeth; operculum with two flaps.

Gonosome.—(not previously described) Gonangia of the regular *Thuiaria* type, not very large, obovate, with an aperture of good size, and two shoulder spines more or less pronounced; each gonangium is inserted without a distinct pedicel just below the hydrotheca.

Distribution.—San Juan Archipelago, Dodds Narrows, Departure Bay, Ucluelet (Fraser); Rose Spit, Naden Harbor, Cape Edenshaw, Nawhitti Bar, Claninnick, Nanoose Bay, north of Gabriola I., Northumberland Channel, Pylades Channel, Gabriola Pass, Porlier Pass, Friday Harbor, Deer Harbor, Copalis.

Although this species has been obtained in many localities at a most all seasons of the year, for a long time no trace of a gonangium appeared. Finally on June 6, 1913, while collecting at low tide on Black Rock at the southwestern entrance of Porlier Pass many fine specimens were obtained and among them several that had empty gonangia, which supplied material for drawing and description. None have been found with the sexual products present.

Thuiaria distans new species

Pl. XXXII, Fig. 123

Trophosome.—Stem erect, geniculate; branching regularly alternate; branches long, slender, geniculate, either unbranched or dichotomously branched; usually three hydrothecæ on the stem between two successive branches on the same side; on the branches the hydrothecæ are alternate, very distant for this genus, each hydrotheca placed at a bend in the branch; when the branch is dichotomously branched there is a hydrotheca in the angle; hydrothecæ largest in the centre, tapering both ways, curved to turn well outward, with the margin vertical, about one-half free; margin without distinct teeth but rather bilabial; operculum of one abcauline flap.

Gonosome.—Unknown.

Distribution.—North of Gabriola I.

Thuiaria fabricii (Levinsen)

Pl. XXXIII, Fig. 124

Sertularia fastigiata FABRICIUS, Fauna Grœnlandica, 1780, p. 458.
Sertularia fabricii LEVINSEN, Vid. Middel. Naturh. Foren., 1892, p. 48.
Thuiaria fabricii FRASER, West Coast Hydroids, 1911, p. 76.

Trophosome.—Stem erect, rather rigid; branches on all sides of the stem, often broken off proximally leaving a stub in each case, distally forming a dense tuft; the density of the tuft is increased by the dichotomous branching which may take place several times; nodes distinct but not regularly placed; hydrothecæ usually nearly opposite but often varying in different parts of the stem and branches; hydrothecæ narrowing slightly from base to margin, distal portion free; margin with two teeth; operculum with two flaps.

Gonosome.—Gonangia borne in two rows on the branches, oblong or obovate, with circular aperture and two lateral shoulder spines.

Distribution.—Puget Sound (Calkins); San Juan Archipelago, Dodds Narrows (Fraser); Alert Bay, Northumberland Channel, off Matia I., off Waldron I., off O'Neale I., off Brown I., Deer Harbor, Griffin Bay, Upright Channel, Port Townsend, Ocean Beach.

Thuiaria robusta Clark

Pl. XXXIII, Fig. 125

Thuiaria robusta CLARK, Alaskan Hydroids, 1876, p. 227.
Thuiaria robusta FRASER, West Coast Hydroids, 1911, p. 76.

Trophosome.—Stem stout, with deeply-cut internodes; branches also stout arising from all sides of the stem, the proximal often broken off and the distal forming a dense tuft; hydrothecæ alternately, not closely placed, proximally almost wholly immersed, distally with a small portion free, long, tubular, very slightly larger at the base than at the margin; margin bi-labiate; operculum with two flaps on the distal hydrothecæ and one flap on the proximal.

Gonosome.—"Gonangia borne in rows on the terminal branchlets, slender with a terminal collar and aperture, and two long, curved spines rising from the antero-lateral corners of the shoulders" (Nutting).

Distribution.—Albatross Station 2875, N. 48° 30′, W. 124° 57′, 40 fathoms (Nutting).

I have not found this species in this region. The description and the trophosome drawing are from an Alaskan specimen which had no gonangia. The description and the drawing of the gonangium are from Nutting.

Thuiaria similis (Clark)

Pl. XXXIII, Fig. 126

Sertularia similis CLARK, Alaskan Hydroids, 1876, p. 219.
Sertularella nana HARTLAUB, Hyd. aus dem Stillen Ocean, 1891, p. 361.
Sertularia tenera NUTTING, Hyd. from Alaska and Puget Sound, 1899, p. 743.
Thuiaria similis NUTTING, American Hydroids, pt. 2, 1904, p. 69.
Thuiaria similis FRASER, West Coast Hydroids, 1911, p. 77.

Trophosome.—Colony bilateral, with the main stem very distinct and much stouter that the branches; branching regularly alternate; hydrothecæ usually in nearly opposite pairs which vary much in the distance from one another, although the distance may be fairly constant in the same colony; hydrothecæ slender, tubular, tapering but slightly to the margin, distal portion free and turned well outward; sometimes they are much prolonged in which case they project for a large portion of their length; margin with two distinct teeth; operculum with two flaps.

Gonosome.—Gonangia small, oval, narrowing more towards the base than towards the margin; a short collar is present with a circular aperture; the surface is free from spines and annulations.

Distribution.—Bare Island (Hartlaub); Puget Sound, Albatross Station 2865, N. 48° 12′, W. 122° 49′, 40 fathoms, Station 3465, N. 48° 21′, W. 123° 14′, 48 fathoms (Nutting); San Juan Archipelago, Dodds Narrows, Departure Bay (Fraser); Rose Spit, Massett, China Hat, Claninnick, Port Renfrew, Nawhitti Bar, north of Gabriola I., Northumberland Channel, Pylades Channel, Ruxton Passage, Gabriola Pass, Gabriola Reefs, off Matia I., off O'Neale I., off Shaw I., off Brown I., San Juan Channel, Deer Harbor, Upright Channel, Griffin Bay, Port Townshend.

In my West Coast paper I have called attention to the great amount of variation of the species and the fact that *Sertularella nana* Hartlaub is almost certainly one of these variations. I believe further that the specimens described by Nutting from Puget Sound as *Sertularia tenera* are also of this species. His figures pl. LXII, fig. 1, A and B, certainly look much more like his figures of *T. similis* in his monograph, pl. X, figs. 7 and 8, than they do like those of *T. tenera* in the same work, pl. XI, fig 10. Colonies obtained from his Puget Sound material bears out this indication. Whether his reference to *T. tenera* in his Albatross material from the same or nearly the same locality is of the same type I do not know. I have not found any specimens of *T. tenera* in any collections from this region but assuming that the Albatross reference is correct, I include *T. tenera* in the list.

Thuiaria tenera (Sars)

Pl. XXXIII, Fig. 127

Sertularia tenera SARS, Bidrag til Kundskaben om Norges Hydroider, 1873, p. 20.
Thuiaria tenera FRASER, West Coast Hydroids, 1911, p. 78.

Trophosome.—Stem rather slender, branches arising from all sides of the stem but somewhat scattered, these branch dichotomously but regularly; hydrothecæ alternate, rather distant, enlarged above the base then narrowing rapidly towards the margin; fully one-half of the hydrotheca is free and projects well outward but the margin is directed upward; margin usually with two large blunt teeth but these may be so low as not to be noticeable; operculum of two flaps or of one abcauline flap.

Gonosome.—Gonangia singly on the branches, oval, with a short, stout collar and wide circular aperture; no very distinct pedicel; surface free from annulations and spines.

Distribution.—Albatross Station 2865, N. 48° 12′, W. 122° 49′, 40 fathoms (Nutting).

As is stated in connection with *T. similis*, I have obtained no specimens of this species from this region but as Nutting has given the above mentioned locality for the species I have included it in the list. The specimen described and figured is from Spitzbergen obtained through the kindness of Dr. Marktanner-Turneretscher.

Thuiaria thuiarioides (Clark)

Pl. XXXIV, Fig. 128

Sertularia thuiarioides CLARK, Alaskan Hydroids, 1876, p. 223.
Thuiaria thuiarioides FRASER, West Coast Hydroids, 1911, p. 78.

Trophosome.—Main stem rather stout; branches from all sides of the stem, placed closely enough to make a dense tuft, branches branch dichotomously; hydrothecæ as nearly being opposite as distinctly alternate, tubular below, narrowing towards the margin, a small portion free; margin circular, facing upwards; operculum of one adcauline flap.

Gonosome.—Gonangia oblong or obovate, with a large circular aperture; two small shoulder spines.

Distribution.—Puget Sound (Calkins); Rose Spit, Clayuquot Sound, Swift-sure Shoal, Copalis.

In one respect this species differs from all other known species of *Thuiaria*, i.e. in the fact that the operculum consists of a single adcauline flap. On account of this difference Broch has placed it with

the genus *Diphasia*[32], but in other respects it is quite unlike a *Diphasia*. It has no internal marsupium in the female gonangium but has a typical *Thuiaria* gonangium. Its mode of growth and method of branching, etc., are distinctly Thuiarian. While noting it as an exception in respect to the operculum, therefore, I see no valid reason for not retaining it in this genus.

Thuiaria thuja (Linnæus)

Pl. XXXIV, Fig. 129

Sertularia thuja LINNÆUS, Syst. Nat., 1758, p. 809.
Thuiaria thuja FRASER, West Coast Hydroids, 1911, p. 78.

Trophosome.—Main stem rigid, not very stout; branches from all sides of the stem, proximal ones usually broken off, leaving a stump; all branches stiff, branching dichotomously several times, making a dense tuft, often spoken as the "bottle brush"; hydrothecæ alternate, closely placed, almost wholly immersed, tubular; margin almost vertical without teeth; operculum a single abcauline flap.

Gonosome.—Gonangia in rows that may be crowded on the stem and proximal portions of the branches, oval, with short collar and large terminal aperture and a short distinct pedicel; surface without annulations or spines.

Distribution.—San Juan Archipelago, Banks I. (Fraser); off Matia I., off Waldron I., Friday Harbor.

Family **Plumularidæ**

Trophosome.—Hydrothecæ growing only on one side of the branches (hydrocladia), sessile, more or less adnate, nematophores always present.

Gonosome.—Gonophores producing fixed sporosacs, which are often protected by special modifications of the branches.

Key to the genera of Plumularidæ found in the Vancouver I. region.

A. Statoplean forms, i.e., those with fixed nematophores that are usually monothalamic
  a. Gonangia protected by corbulæ which are modified branches or hydrocladia . . . . *Aglaophenia*
  b. Gonangia protected by branchlets that are appendages of hydrocladia . . . . *Cladocarpus*

B. Eleutheroplean forms, i.e., those with movable nematophores that are usually bithalamic

[32]Die Hydroiden der Arktischen Meere, 1909, p. 224.

a. Gonangia not specially protected, hydrocladia pinnately arranged; each hydrocladium bears more than one hydrotheca .... *Plumularia*

Genus **AGLAOPHENIA**

Trophosome.—Hydrothecal margin provided with sharp teeth, posterior intrathecal ridge present, one mesial and two supracalycine nematophores for each hydrotheca always present.

Gonosome.—Gonangia enclosed in true corbulæ, formed of modified pinnæ. There are no hydrothecæ at the base of the gonangial leaves.

Key to the species of *Aglaophenia* found in the Vancouver I. region. Margin of the hydrothecæ with 11 uneven teeth.

A. Mesial nematophore with an expanded free portion. . *A. latirostris*

B. Mesial nematophore with free portion narrowed towards the extremity .... *A. struthionides*

Aglaophenia latirostris Nutting

Pl. XXXIV, Fig. 130

Aglaophenia latirostris Nutting, American Hydroids, pt. 1, 1900, p. 101.

Aglaophenia latirostris Fraser, West Coast Hydroids, 1911, p. 80.

Trophosome.—"Colony unbranched, attaining a height of about 2 inches stem not fascicled, divided into regular internodes, each of which bears a hydrocladium; hydrocladia lying in the same plane, alternate, closely approximated and projecting at right angles from the stem; hydrocladial internodes distinct, each with a septal ridge behind the intrathecal ridge. Hydrothecæ closely approximated, obconical, margin expanded and surrounded by eleven very irregular jagged teeth, the anterior being retrorse, the next directed forward, the remaining four on each side being in two pairs of sharply pointed teeth; intrathecal ridge evident, oblique, reaching nearly around the hydrotheca; lateral nematophores rather small for this group, not reaching the top of the hydrotheca; mesial nematophore very large, adnate to the front of the hydrotheca nearly to the top and then projecting forward into an expanded spout-like distal extremity, which often reaches a considerable distance in front of and above the hydrotheca" (Nutting).

Gonosome.—"Corbula closed, composed of about eight pairs of moderately narrow leaves, each of which bears a row of nematophores on its distal edge and another on its inner proximal edge as in *A.*

struthionides. There is an aperture between the bases of adjacent leaves, and no prominent spur at the bases. There are two hydrothecæ between the corbula and the stem" (Nutting).

Distribution—Puget Sound (Fraser).

This species was reported in my previous paper from some of Prof. Nutting's material. I have not found it elsewhere. The description and the figures are from Nutting.

Aglaophenia struthionides (Murray)

Pl. XXXIV, Fig. 131

Plumularia struthionides MURRAY, Ann. and Mag. N.H., 3rd ser., 5, 1860, p. 251.

Aglaophenia struthionides FRASER, West Coast Hydroids, 1911, p. 80.

Trophosome.—Colonies usually growing in large conspicuous bunches, which may appear to view on the rocks at low tide. The stems are usually unbranched but occasionally scattered branches are given off, making a wide angle with the stem and apparently loosely connected with it; the branch has the same appearance as the main stem; the stem is divided into regular short internodes, each of which bears a hydrocladium; the hydrocladia are regularly alternate but those on the two sides do not come out in the same plane, but converge to a considerable extent in the one direction; the hydrocladia are directed outward and slightly upward, they are regularly graded in length to give the "ostrich-plume" effect; they are divided into regular internodes, each of which bears a hydrotheca, which occupies practically all the one side hence the hydrothecæ are closely approximated. Each hydrotheca has eleven teeth the odd one which is farthest from the hydrocladium is pointed backward but the one on each side of it is pointed forward, these three are quite sharp, the remaining four on each side are much blunter and are quite irregular; the intrathecal ridge is evident; the supracalycine nematophores are large but do not overtop the hydrotheca; the mesial nematophore is large the free portion varies much in length, but seldom reaches much beyond the top of the hydrotheca; the cauline nematophore at the base of the hydrocladium is large and triangular.

Gonosome.—Corbulæ on hydrocladia similar in position to other hydrocladia, bearing three hydrothecæ on proximal portion; corbulæ closed when mature, with as many as thirteen pairs of leaves, each with a row of nematophores showing along the margin; there is no pronounced process at the base of the leaves.

Distribution.—Puget Sound (Dr. Steindachner); Townshend Bay (Calkins); Puget Sound to San Diego (Torrey); San Juan Archipelago,

Victoria, Port Renfrew, Ucluelet (Fraser); Queen Charlotte Is., Clayuquot Sound, Departure Bay, Dodds Narrows, off Matia I., Upright Channel, off Blakely I., Deer Harbor, off O'Neale I., off Waldron I., San Juan Channel, Port Townshend, Griffin Bay, Copalis.

Genus **CLADOCARPUS**

Trophosome.—Hyrothecæ deep with the margin smooth or with low blunt teeth; mesial nematophore short.

Gonosome.—Gonangia borne on the stem, at the bases of the hydrocladia protected by processes (phylactogonia) springing from the base of the hydrocladia; these have nematophores but no hydrothecæ.

Cladocarpus vancouverensis new species

Pl. XXXV, Fig. 132

Trophosome.—Stems simple, unbranched in all the specimens obtained, longest specimen 12 cm.; hydrocladia regularly alternate, those on the two sides not in the same plane, divided into regular internodes; hydrothecæ much deeper than wide, the two margin with one central, distinct, but not large, sharp tooth, the remainder weakly crenulated. The supracalycine nematophores are long but do not reach beyond the hydrotheca; the mesial nematophore is projected outward, distal portion free, jointed near the base; a septal ridge is present at the base of the supracalycine nematophore, one at the base of the hydrotheca and two others regularly placed between these.

Gonosome.—Gonangia borne on the front of the stem and protected by phylactogonia, which are two-pronged, but each of these prongs may be two-pronged; they are oval or somewhat ovate with distal end rounded.

Distribution.—Lasqueti I., West Rocks, Northumberland Channel.

I believe this is the first record of a species of *Cladocarpus* from the west coast of North America. Most of the species are tropical but some have been found in the North Atlantic or in the Arctic near by. Almost without exception the specimens have been obtained from deep water and this seems especially true of the forms found in the colder waters. The records read 80 fathoms or over. Ritchie records two species, *C. bonneviecæ* and *C. campanulatus*[33] but does not give the depth at which they were found. Unless these were in shallower water, there have been no northern specimens found at as little

[33]Some northern hydroid zoophytes, 1912, p. 223-226.

depth as were the specimens of this species. Those dredged north of Lasqueti were in a depth of 25-30 fathoms and the others in a depth still less, 15-20 fathoms. The largest specimen was obtained in Northumberland Channel near the entrance to Dodds Narrows on August 12. It was well provided with gonangia.

Genus PLUMULARIA

Trophosome.—Hydrocladia unbranched, pinnately arranged, each having more than one hydrotheca; hydrothecæ with entire margin; all nematophores movable.

Gonosome.—Gonangia without extra protection.

Key to the species of *Plumularia* found in the Vancouver I. region.

A. Septal ridges pronounced in all parts of the hydrocladia; colonies rather large.
  a. Colony much branched .... *P. corrugata*
  b. Colony unbranched or but slightly branched .... *P. lagenifera*

B. Septal ridges absent or inconspicious on some of the internodes at least; colonies small.
  a. Internodes of the stem often have more than one hydrocladium; no intermediate internodes in the hydrocladia *P. goodei*
  b. Internodes of the stem with one hydrocladium only; intermediate internodes present in the hydrocladia ...... *P. setacea*

Plumularia corrugata Nutting

Pl. XXXV, Fig. 133

Plumularia corrugata NUTTING, American Hydroids, pt. 1, 1900, p. 64.
Plumularia corrugata FRASER, West Coast Hydroids, 1911, p. 82.

Trophosome.—Stem simple, erect, with irregular annulations at the base, divided into regular internodes, each of which gives off a hydrocladium from a process at its distal end; hydrocladia alternate lying in the same plane, the proximal ones unbranched but the distal usually giving off several branchlets; hydrocladia slender, consisting of alternating hydrothecate and non-hydrothecate internodes; the proximal internode is short, with one septal ridge, non-hydrothecate, the second, with usually four well pronounced ridges, bears a hydrotheca, which is about as deep as broad, placed slightly distad to the centre, the third has two septal ridges, and the remainder of the hydrocladium consists of internodes like the second and third, alternating; the intermediate internode is somewhat shorter than the hydrothecate but each is rather long and slender; there are two supracalycine nematophores, a mesial on each hydrocladial internode with the

exception of the first, one on each cauline internode on the side opposite the process for the hydrocladium and one in the axil of each hydrocladium.

Gonosome.—Gonangia of two kinds,—one nearly oval, about three times as long as broad with a truncated top or the appearance of a slight collar and the other elongated, with or without a bottle neck. In both cases they are found attached to the process which supports the hydrocladium.

Distribution.—San Juan Archipelago (Fraser); Nanoose Bay, Departure Bay, Clarke Rock, north of Gabriola I., Protection I., Gabriola Pass, off Matia I.

Plumularia goodei Nutting

Pl. XXXVI, Fig. 134

Plumularia echinulata var. CALKINS, Hyd. of Puget Sound, 1899, p. 363.
Plumularia goodei NUTTING, American Hydroids, pt. 1, 1900, p. 64.
Plumularia goodei FRASER, West Coast Hydroids, 1911, p. 82.
Plumularia echinulata FRASER, West Coast Hydroids, 1911, p. 82.

Trophosome.—Colony small, less than an inch in height; stems growing from a coarse network of rootstocks; stem simple, divided into regular internodes, each of which may bear one or two unbranched hydrocladia. (Torrey says there may be three). In the majority of specimens examined, the proximal internode in nearly all cases bore two hydrocladia, while the distal bore but one each; in either case the hydrothecæ are alternate; there may be one or two non-hydrothecate internodes at the base of the hydrocladium or these may be absent; all the rest of them bear one hydrotheca each; intermediate internodes rare but sometimes present; hydrothecæ nearly equal in depth and breadth, margin flaring; septal ridges absent; two supracalycine nematophores, one mesial nematophore on each hydrocladial internode and one or two in the axil of the hydrocladium; all monothalamic.

Gonosome.—Gonangia taking the place of hydrocladia, the processes from the internode supporting these as they do the hydrocladia, large, irregularly oblong, truncate distally, tapering slightly proximally.

Distribution.—Port Townshend (Calkins); Port Renfrew (Fraser); Gabriola Pass, Friday Harbor.

Torrey has called attention to the fact that there are not always two hydrocladia to an internode, as stated by Nutting. Very often there is but one and in some instances I have found a short internode

intercalated, without a hydrocladium. I have not noticed three to the internode but Torrey mentions that number. The presence of an occasional intermediate internode in the hydrocladia has not been mentioned. Taking these points into consideration, I am strongly inclined to believe that *P. goodei* and *P. plumularoides* Clark are the same species. The fact that *P. plumularoides*, according to Torrey, has monothalamic nematophores, makes the probability greater. The only difference that Torrey gives are: "The internodes of both stem and hydrocladia are much longer than those of the latter species (*P. goodei*) and the hydrocladia are not so strongly arched." These are very variable points upon which to base a specific distinction. Clark's specimens of *P. plumularoides* were 20 mm. in length, corresponding well with those of *P. goodei*. Torrey's specimens were but fragments. If the species are the same, the name *P. plumularoides* should be retained but I hesitate to make the change when Torrey, having specimens of the two to compare, considered them to be separate species.

Calkins' species *P. echinulata* var. I think should be placed here without doubt. The presence of occasional intermediate internodes and the single hydrocladium to an internode, were difficulties in the way of placing it with *P. goodei* in my previous paper but these are difficulties no longer. In other respects it corresponds perfectly with *P. goodei*. Nutting in his monograph has not recognized Calkins' species *P. echinulata*, but he seems to have overlooked it altogether as I do not find it included with any of his described species.

Plumularia lagenifera Allman

Pl. XXXVI, Fig. 135

Plumularia lagenifera ALLMAN, Proc. Linn. Soc., London, 1885, p. 157.

Plumularia californica MARKTANNER-TURNERETSCHER, Ann. des k.k. Nat. Hofm., 1890, p. 255.

Plumularia lagenifera NUTTING, American Hydroids, pt. 1, 1900, p. 65.

Plumularia palmeri NUTTING, Ibid., p. 65.

Plumularia lagenifera FRASER, West Coast Hydroids, 1911, p. 82.

Plumularia palmeri FRASER, Ibid., p. 84.

Trophosome.—Colonies plumose, from 5 to 10 cm. in height, growing in clusters; stem simple, divided into regular internodes, each of which bears a hydrocladium; the hydrocladia are alternate but are not in the same plane, two in succession make an angle of 100°-120° with each other; they are short, seldom branched, divided

into alternate non-hydrothecate and hydrothecate internodes, the proximal being non-hydrothecate; it is shorter than the intermediate internodes and has but one septal ridge, while each of the others have two. In each internode which bears a hydrotheca there are usually three ridges well marked, one at each end and one at the base of the hydrotheca; the hydrotheca is much nearer the distal than the proximal end of the internode, its depth and breadth are nearly equal; in most cases the internode is swollen below the hydrotheca. There are two supracalycine nematophores, a mesial one on each hydrocladial internode with exception of the first, one on each cauline internode on the side opposite the hydrocladial process and two in the axil of each process.

Gonosome.—Gonangia borne on the hydrocladial processes of the cauline internodes; in the one diameter the gonangium is oval, with a distinct neck, which is sometimes slightly curved and a terminal opening, the proximal end is tapered to form a short pedicel; in the other diameter it is much flattened so that looking at it edgeways it looks not unlike the gonangium of *P. setacea.*

Distribution.—Puget Sound (Dr. Steindachner); Vancouver Island (Allman); Victoria (Nutting); San Juan Archipelago, Port Renfrew, Ucluelet, Dodds Narrows, Hope I. (Fraser); Amphitrite Point, Swiftsure Shoal, off Massett, Northumberland Channel, Gabriola Pass.

In my previous paper I mentioned the resemblance between *P. palmeri* and *P. lagenifera.* Since then much additional material has been obtained and I can see no reason for regarding them as distinct species. Nutting gives as the distinction between the two that *P. lagenifera* may be branched and has hydrothecæ wider than deep, while *P. palmeri* is not branched and the hydrothecæ are not wider than deep. With regard to the branching it is not very satisfactory to judge, that because colonies from one collection in one locality are branched or otherwise, they are always so. Very few specimens that I have seen, even those which are undoubtedly *P. lagenifera,* have any sign of branches. That the relative depth and breadth of the hydrothecæ cannot be depended upon is shown by the fact that the hydrotheca of *P. lagenifera* shown in fig. 10, pl. VI, is deeper than wide, while the upper one of *P. palmeri* in fig. 4 of the same plate, is wider than deep, and these drawings were made from camera lucida sketches. One other point is mentioned, viz., that the septa at the base of the hydrotheca in *P. palmeri* are fainter than in *P. lagenifera.* When the septa are present in both cases, the degree of faintness can scarcely be considered as a good specific character, particularly so, although there may be this distinction throughout a whole colony,

there may be different degrees in the same colony. I gave drawings of gonangia of *P. palmeri* but I have since found that these vary as much as the hydrothecæ do.

Plumularia setacea (Ellis)

Pl. XXXVI, Fig. 136

Corallina setacea Ellis, Nat. Hist. Corallines, 1755, p. 19.
Plumularia setacea Fraser, West Coast Hydroids, 1911, p. 84.

Trophosome.—Colony not large, sometimes reaching a height of 50 mm. but often much less; stem simple, divided into regular internodes, each bearing a hydrocladium, which is seldom branched; the hydrocladia are regularly alternate and are in the same plane. After the first internode which is short and without a hydrotheca, hydrothecate and intermediate internodes alternate; the hydrotheca is placed nearer the distal end of the internode; in many cases scarcely any internodal septa can be seen but in other cases there may be an indication of as many as there are in *P. lagenifera*, in some parts of the colony; there are two supracalycine nematophores, one mesial nematophore to each hydrocladial internode, with the exception of the proximal, one on each cauline internode on the side opposite the hydrocladial process and one in the axil of that process.

Gonosome.—Gonangia borne on the hydrocladial processes of the cauline internodes, much elongated, usually with a long neck and circular aperture.

Distribution.—Victoria (Torrey); Pt. Wilson (Calkins); San Juan Archipelago (Fraser); Ucluelet, Northumberland Channel, Porlier Pass, Friday Harbor.

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PLATE I.

FIG. 1. *Endocrypta huntsmani.*

A. Natural size.

B. C. D. E. Zooids showing different positions on the proboscis and different stages of medusa-buds.

F. G. Forked zooids.

H. Medusa just after liberation.

Note.—In these as in all the other drawings not showing the natural size, the magnification is 20 diameters unless other explanation is given.

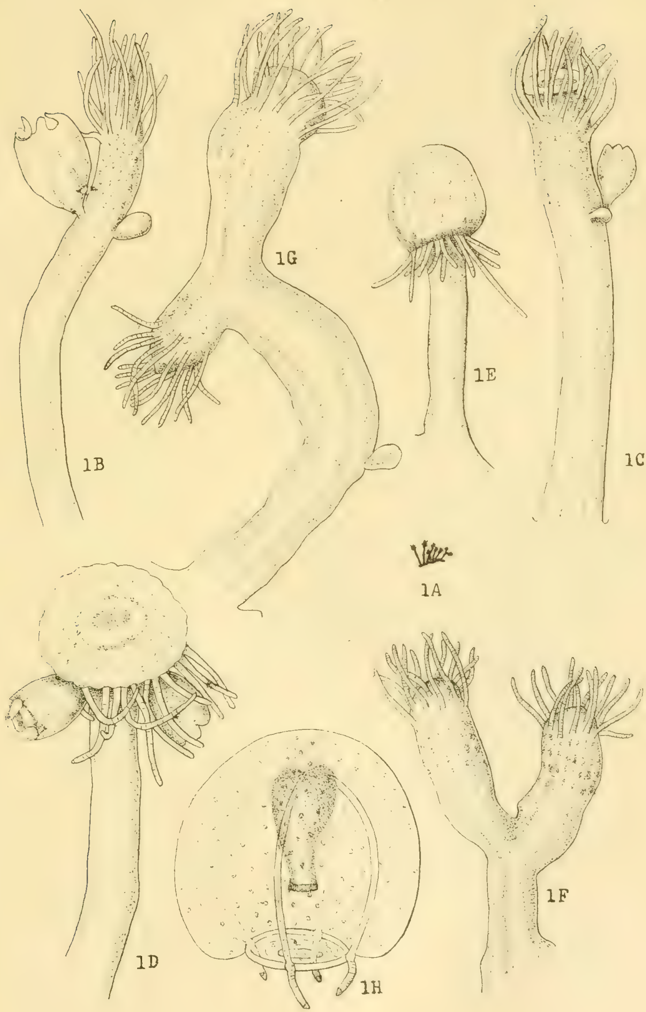
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PLATE II.

FIG. 2. *Corydendrium fruticosum.*

A. Natural size.

B. Portion of branch showing hydranths.

FIG. 3. *Coryne crassa.*

A. Natural size.

B. Hydranth with male sporosacs.

C. Hydranth with female sporosacs.

FIG. 4. *Syncoryne mirabilis.*

A. Natural size.

B. C. Hydranths with medusa-buds.

D. Portion of stem to show branching.

E. Young hydranth.

PLATE II.

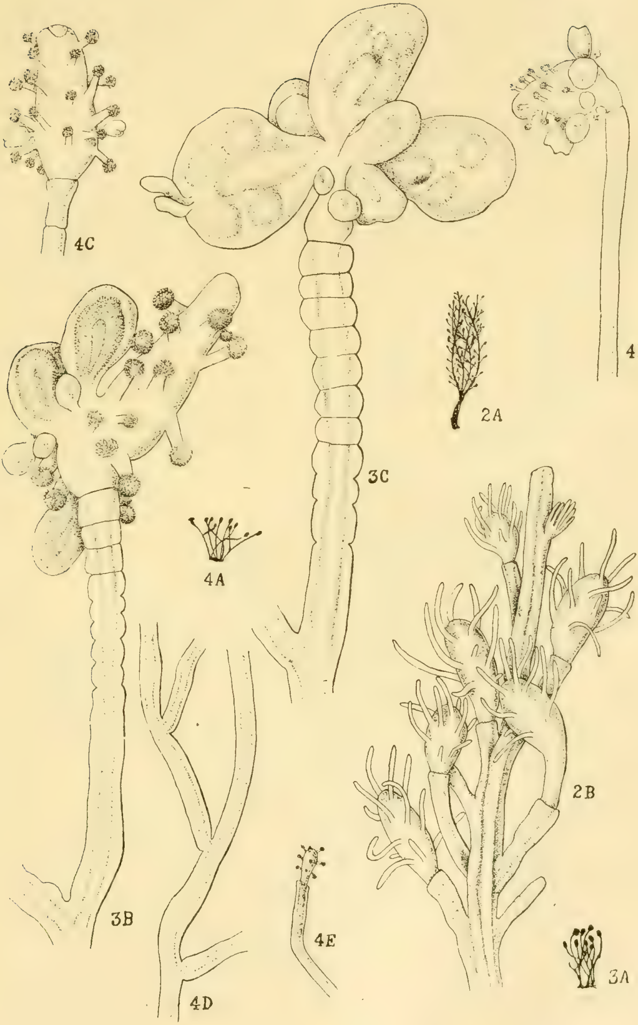

PLATE III.

FIG. 5. *Bimeria robusta.*
A. B. Hydranths (After Torrey).

FIG. 6. *Garveia annulata.*
A. Natural size.
B. Portion of fascicled stem.
C. Gonophores.

PLATE III.

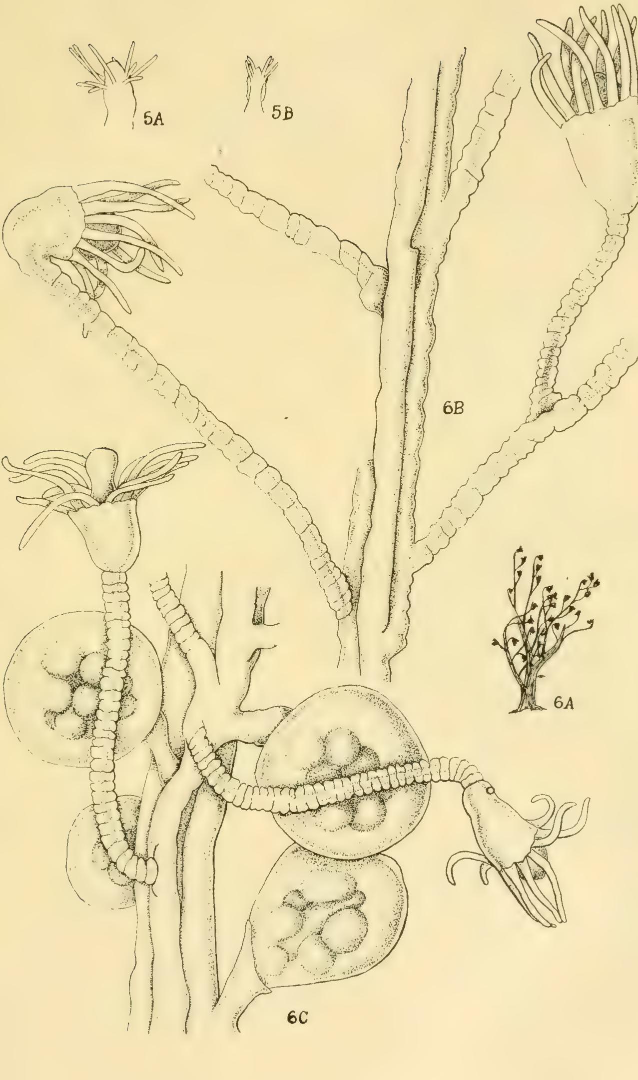

Plate IV.

Fig. 7. *Bimeria gracilis.*

A. Natural size.

B. Portion of fascicled stem.

C. Portion of branch.

D. Portion of branch showing gonophore.

Fig. 8. *Garveia grœnlandica.*

A. Natural size.

B. Hydranth and pedicel.

C. Gonophores.

Fig. 9. *Bougainvillia glorietta.*

A. Natural size.

B. Portion of stem showing mode of branching, hydranths and gonophores.

Fig. 10. *Bougainvillia mertensi.*

A. Natural size.

B. Portion of fascicled stem.

C. Terminal portion of branch.

D. Gonophore.

PLATE IV.

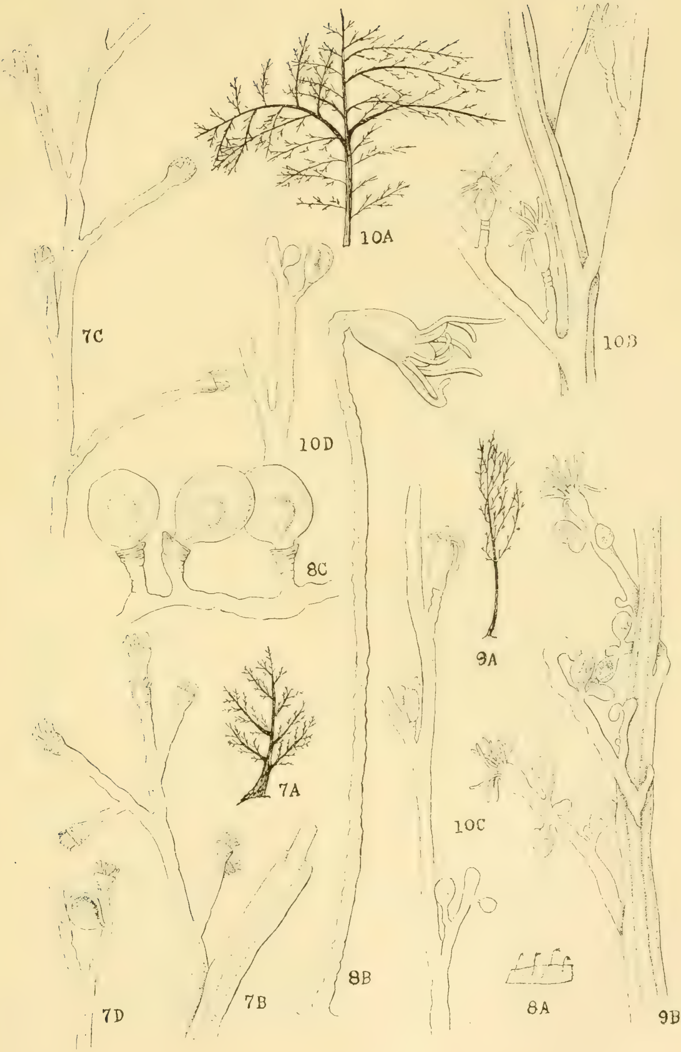

PLATE V.

FIG. 11. *Perigonimus repens.*
A. Natural size.
B. Terminal portion of stem.
C. D. Gonophores.

FIG. 12. *Endendrium californicum.*
A. Natural size.
B. Branches showing hydranths.
C. Gonophores (After Torrey).

FIG. 13. *Eudendrium capillare.*
A. Natural size.
B. Female gonophores.
C. Male gonophores.

FIG. 14. *Eudendrium insigne.*
A. Natuial size.
B. Branch with hydranths.
C. Female gonophores.
D. Male gonophores.

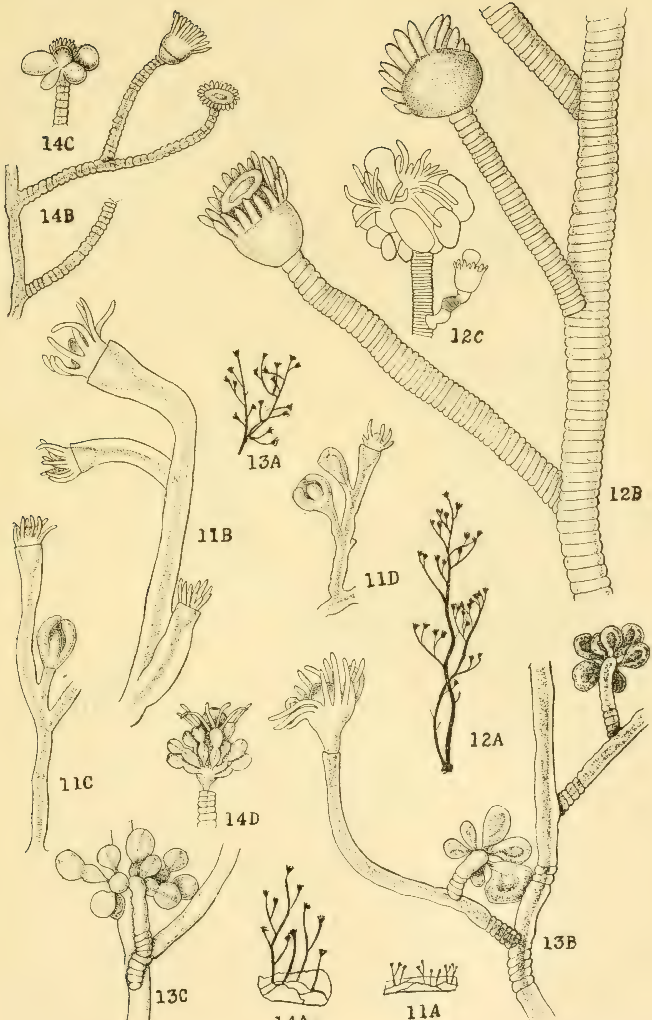
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Plate VI.

Fig. 15. *Eudendrium rameum.*

A. Natural size.

B. Female gonophores.

C. Male gonophores (After Jäderholm).

Fig. 16. *Eudendrium tenellum.*

A. Natural size.

B. Single colony.

C. Male gonophore.

D. Female gonophore.

Fig. 17. *Eudendrium vaginatum.*

A. Natural size.

B. Hydranths and male gonophores.

C. Female gonophores (After Nutting).

PLATE VI.

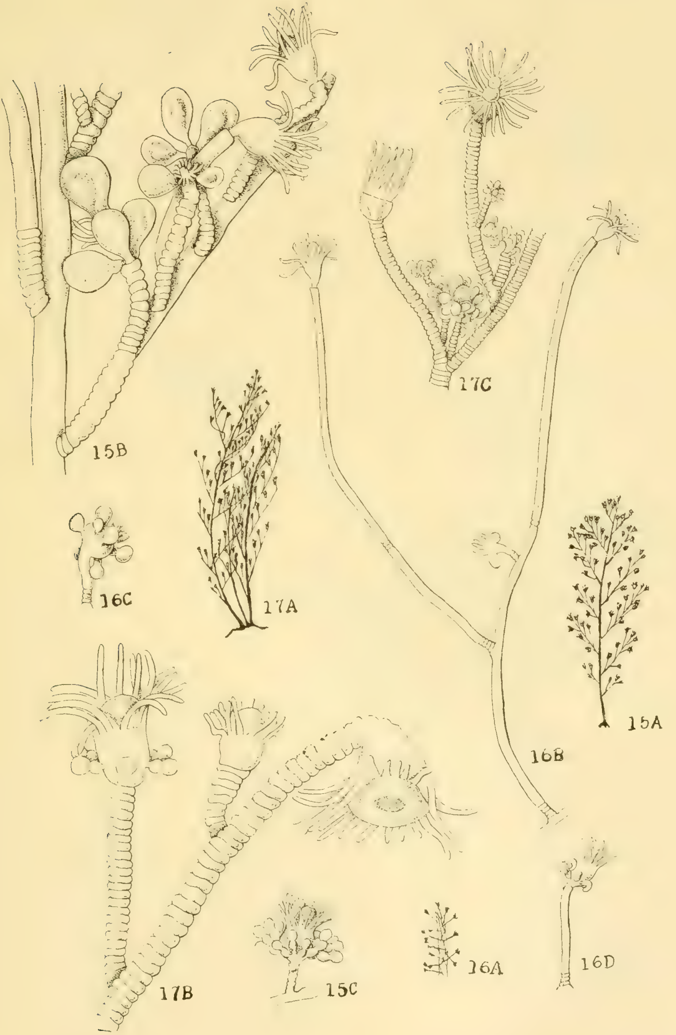

PLATE VII.

FIG. 18. *Hydractinia aggregata.*

A. Natural size.
B. C. Nutritive zooids.
D. Male zooid.
E. Female zooid.
F. Spine.

FIG. 19. *Hydractinia milleri.*

A. Natural size.
B. Large zooid.
C. Zooid showing extended proboscis.
D. Male zooid.
E. Female zooid.
F. Spine.

PLATE VII.

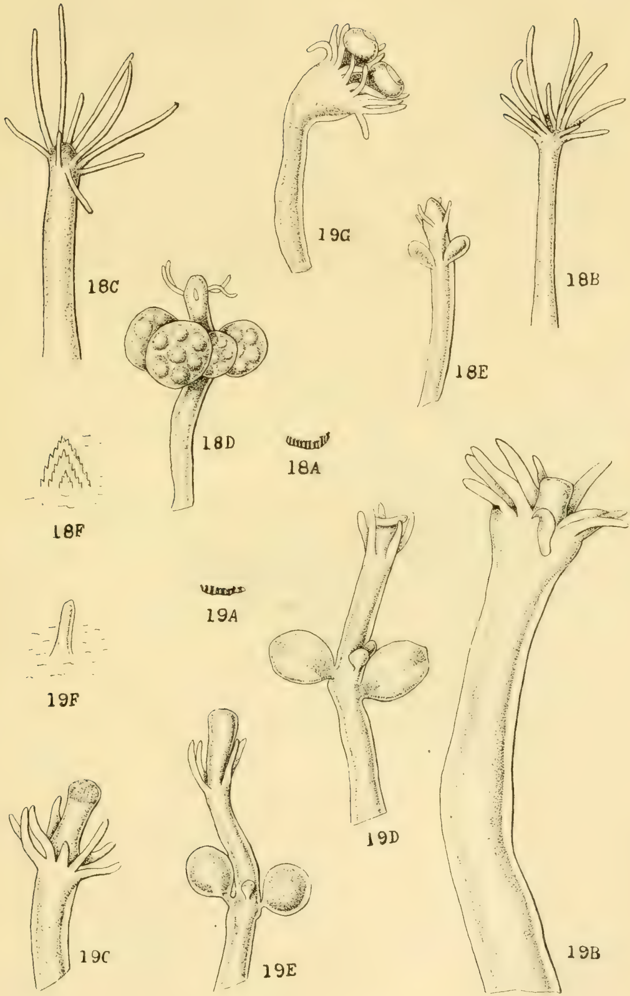

Plate VIII.

Fig. 20. *Tubularia crocea.*

A. Natural size.

B. Hydranth showing gonophores.

Fig. 21. *Tubularia harrimani.*

A. Natural size.

B. Colony showing bunches of gonophores (After Nutting).

C. Gonophores further enlarged (After Nutting).

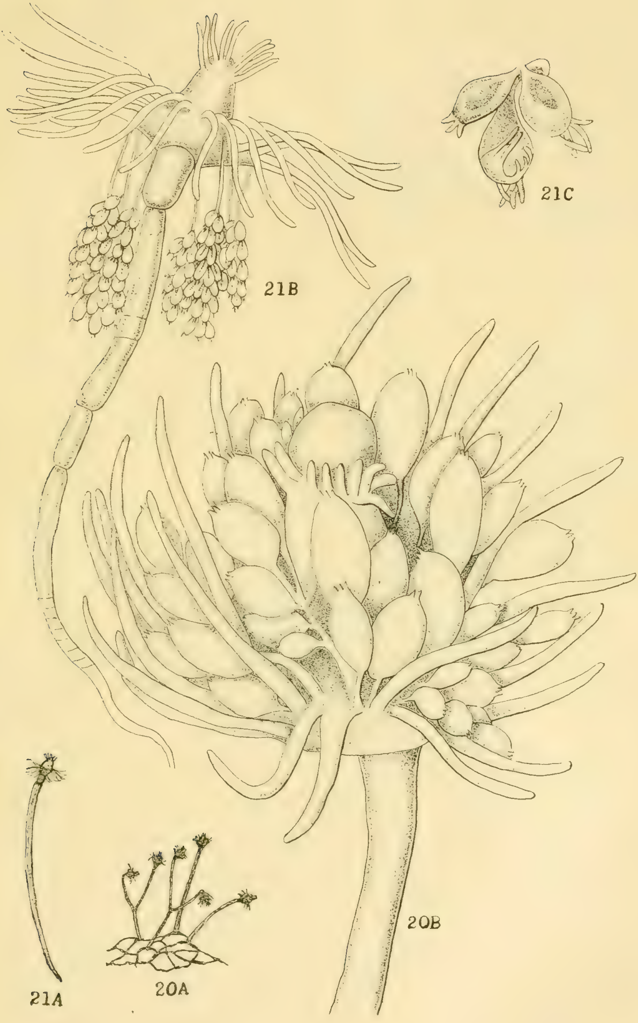
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PLATE IX.

FIG. 22. *Tubularia indivisa.*

A. Natural size.

B. Hydranth with gonophores (About 1/6 usual magnification).

FIG. 23. *Tubularia larynx.*

A. Natural size.

B. Hydranth and gonophores.

C. Young hydranth.

D. Abnormal hydranth.

PLATE IX.

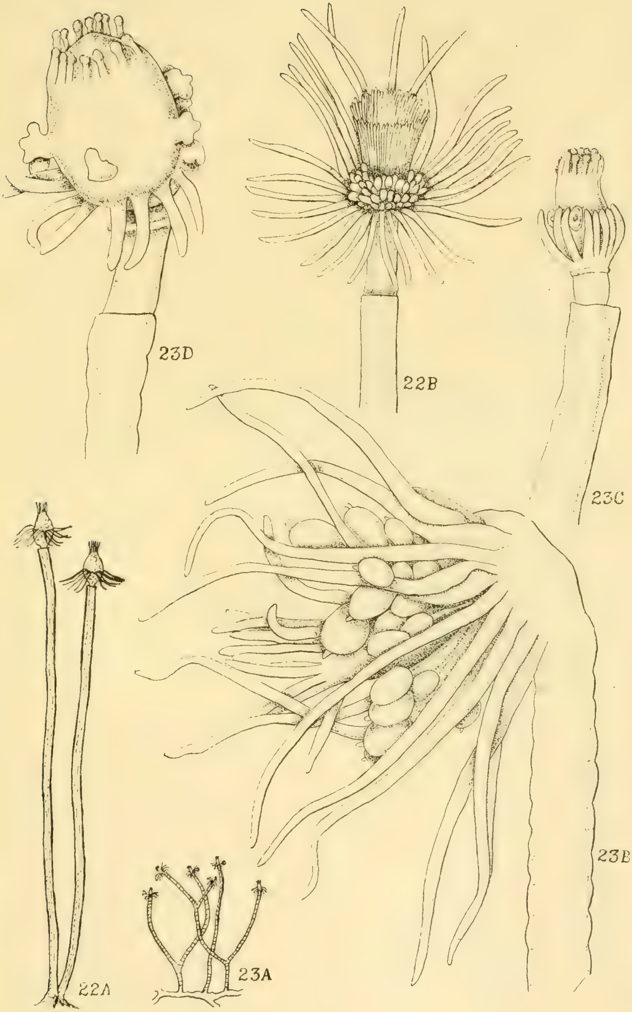

Plate X.

Fig. 24. *Hybocodon prolifer.*

A. Hydranth and gonophores (After L Agassiz).

B. Medusa.

Fig. 25. *Campanularia denticulata.*

A. Natural size.

B. Hydrotheca and pedicel.

Fig. 26. *Campanularia everta.*

A. Natural size.

B. C. Hydrothecæ and pedicels.

D. E. Gonophores.

Fig. 27. *Campanularia exigua.*

A. Colony (After Hincks).

B. Gonophore (After Hincks).

Fig. 28. *Campanularia fusiformis.*

A. B. Hydrothecæ (After Clark).

C. Gonophore (After Clark).

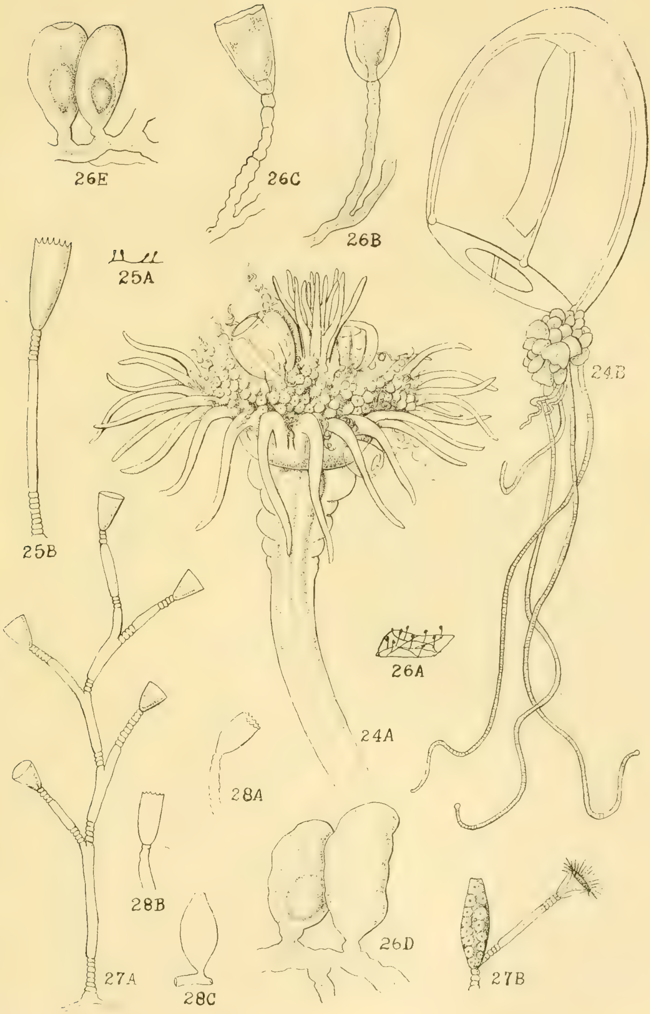
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Plate XI.

Fig. 29. *Campanularia gelatinosa.*

A. Terminal portion of colony natural size.

B. Portion of branch showing hydrothecæ.

C. Gonophore.

Fig. 30. *Campanularia grœnlandica.*

A. Natural size.

B. Hydrothecæ and pedicels.

C. Gonophore.

Fig. 31. *Campanularia integra.*

A. Natural size.

B. C. Hydrothecæ and pedicels.

D. Gonophore.

Fig. 32. *Campanularia longitheca.*

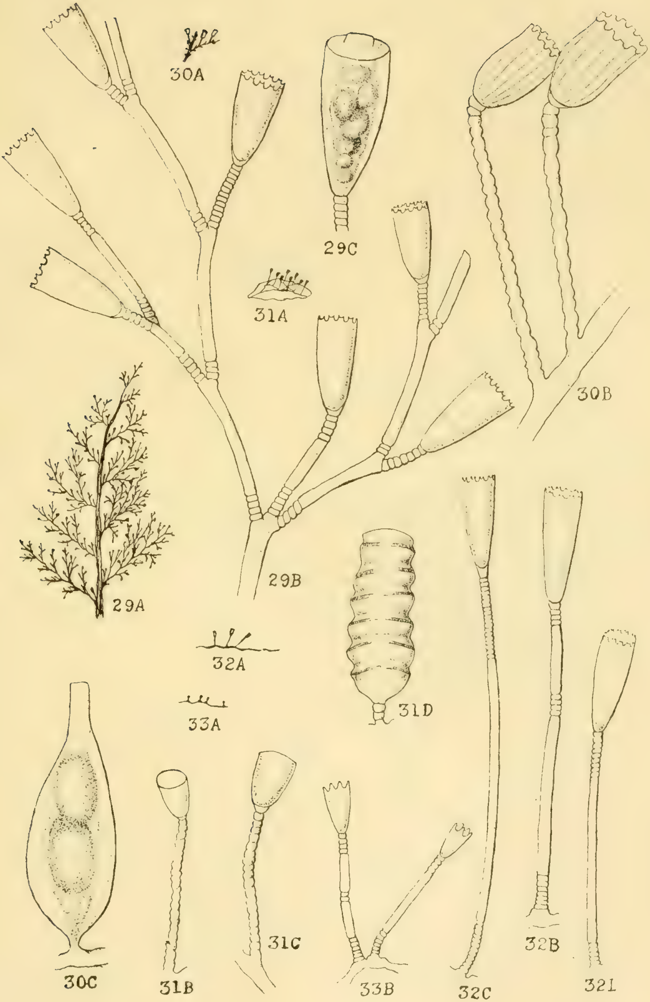
A. Natural size.

B. C. D. Hydrothecæ with pedicels.

Fig. 33. *Campanularia raridentata.*

A. Natural size.

B. Two hydrothecæ with pedicels.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321

Plate XII.

Fig. 34. *Campanularia regia.*

A. Natural size.
B. Pedicel and hydrotheca showing reduplication of margin
C. Hydrotheca and hydranth.
D. Gonophore.

Fig. 35. *Campanularia speciosa.*

A. Natural size.
B. Hydrotheca of smaller type.
C. Hydrotheca of larger type and gonangium.

Fig. 36. *Campanularia urceolata.*

A. Natural size.
B. C. Hydrothecæ with pedicels.
D. Female gonophores.
E. Male gonophores.

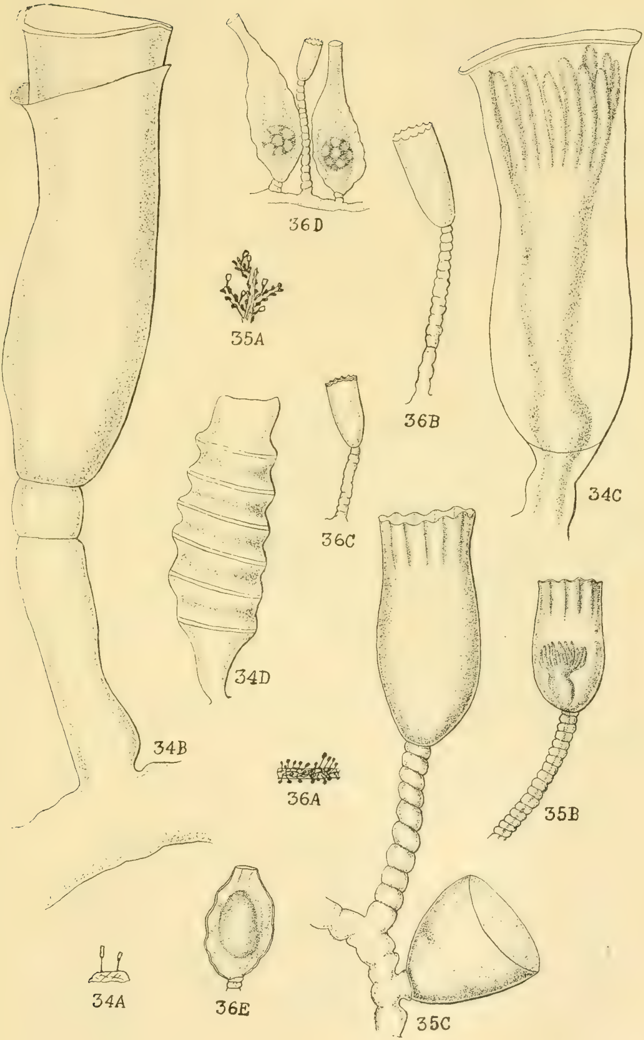
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Plate XIII.

Fig. 37. *Campanularia verticillata.*

A. Natural size.

B. Portion of fascicled stem showing whorl of hydrothecæ.

C. Gonophore.

Fig. 38. *Campanularia volubilis.*

A. Natural size.

B. Hydrotheca and pedicel.

C. Gonophore.

Fig. 39. *Clytia attenuata.*

A. Natural size.

B. Colonies showing branching (After Calkins).

C. Hydrotheca and hydranth (After Calkins).

D. Gonophore (After Calkins).

Fig. 40. *Clytia cylindrica.*

A. Natural size.

B. Hydrotheca and pedicel.

C. Gonophore.

Fig. 41. *Clytia edwardsi.*

A. Natural size.

B. Portion of colony showing hydrothecæ and gonophore.

C. Gonangium growing from stolon.

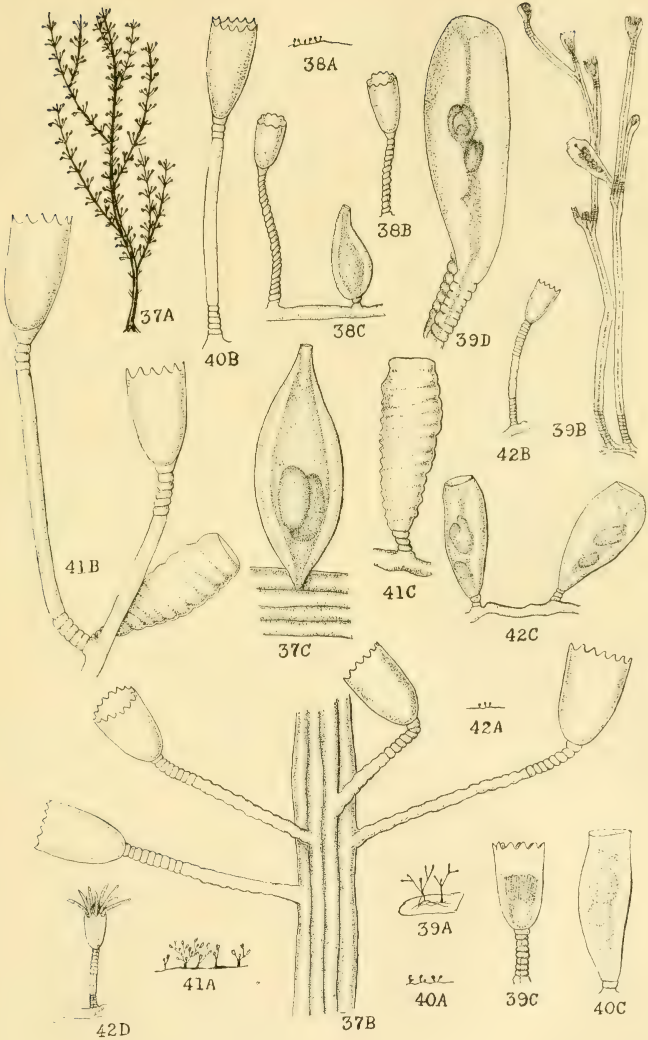
Fig. 42. *Clytia inconspicua.*

A. Natural size.

B. Hydrotheca and pedicel.

C. Gonophores.

D. Individual grown from the egg in the laboratory.



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42C
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39C
40C
42D
37B

Plate XIV.

Fig. 43. *Clytia johnstoni.*

A. Natural size.

B. C. Hydrothecæ and pedicels.

D. Gonangium.

Fig. 44. *Clytia kincaidi.*

A. Natural size.

B. Hydrothecæ with pedicels.

C. D. Gonophores.

Fig. 45. *Eucopella caliculata.*

A. Natural size.

B. Hydrotheca, hydranth and pedicel.

C. Gonophore.

Fig. 46. *Gonothyræa clarki.*

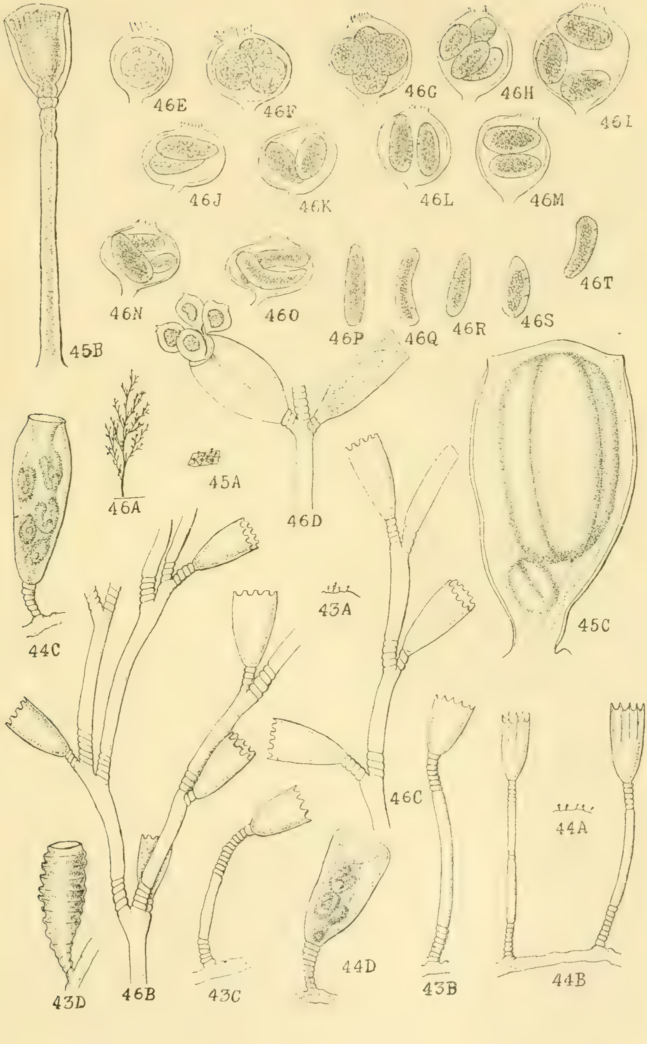
A. Natural size.

B. Portion of stem showing mode of branching.

C. Terminal portion of branch showing hydrothecæ.

D. Gonophores.

E.——T. Various stages in development of planulæ.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45C
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45A
46D
44C
43A
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43D
46B
43C
44D
43B
44B

Plate XV.

Fig. 47. *Gonothyræa gracilis.*

A. Natural size.
B. Hydrotheca and gonophore.
C. Large gonophore.
D. Much elongated hydrotheca and gonangium.
E. Elongated gonangium.

Fig. 48. *Gonothyræa inornata.*

A. Natural size.
B. Portion of branch showing hydrothecæ.
C. Gonophores.

Fig. 49. *Obelia borealis.*

A. Natural size
B. Portion of stem showing mode of branching and hydrothecæ.
C. Gonophore.

Fig. 50. *Obelia dichotoma.*

A. Natural size.
B. Portion of stem showing hydrothecæ and gonophores.

PLATE XV.

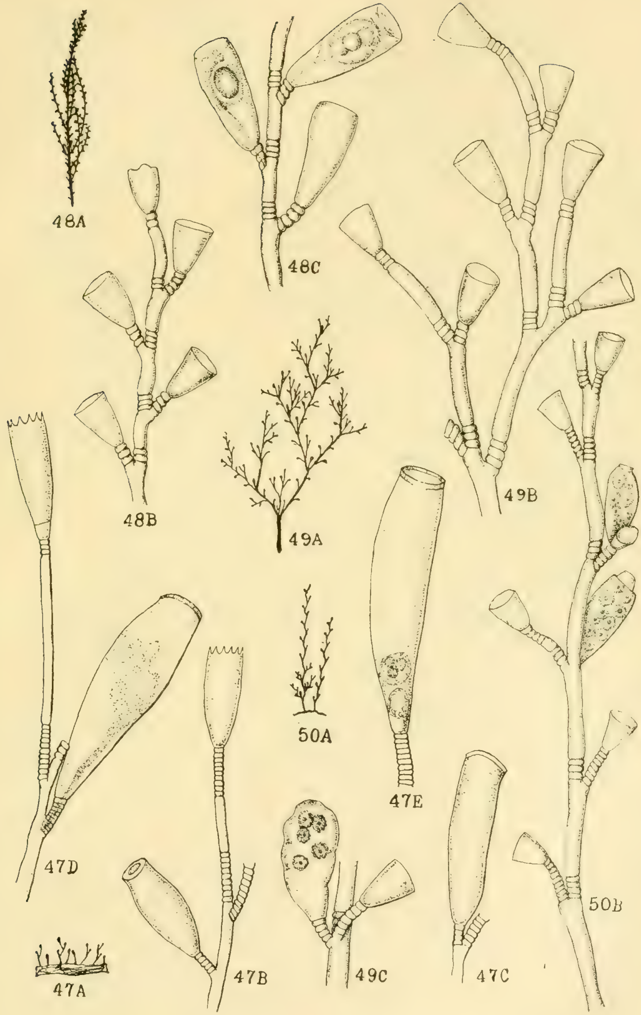


Plate XVI.

Fig. 51. *Obelia dubia.*
- A. Natural size.
- B. Portion of stem showing hydrothecæ.
- C. Gonophore.

Fig. 52. *Obelia fragilis.*
- A. Natural size (After Calkins).
- B. Portion of hydrocaulis (After Calkins).
- C. Hydrotheca and hydranth (After Calkins).

Fig. 53. *Obelia gracilis.*
- A. Natural size.
- B. Portion of stem showing hydrothecæ.
- C. Gonophores

Fig. 54. *Obelia griffini.*
- A. Natural size.
- B. Portion of stem showing mode of branching and hydrothecæ.
- C. Gonophore.

Fig. 55. *Obelia longissima.*
- A. Natural size.
- B. Portion of stem showing hydrothecæ, gonophore and mode of branching.

PLATE XVI.

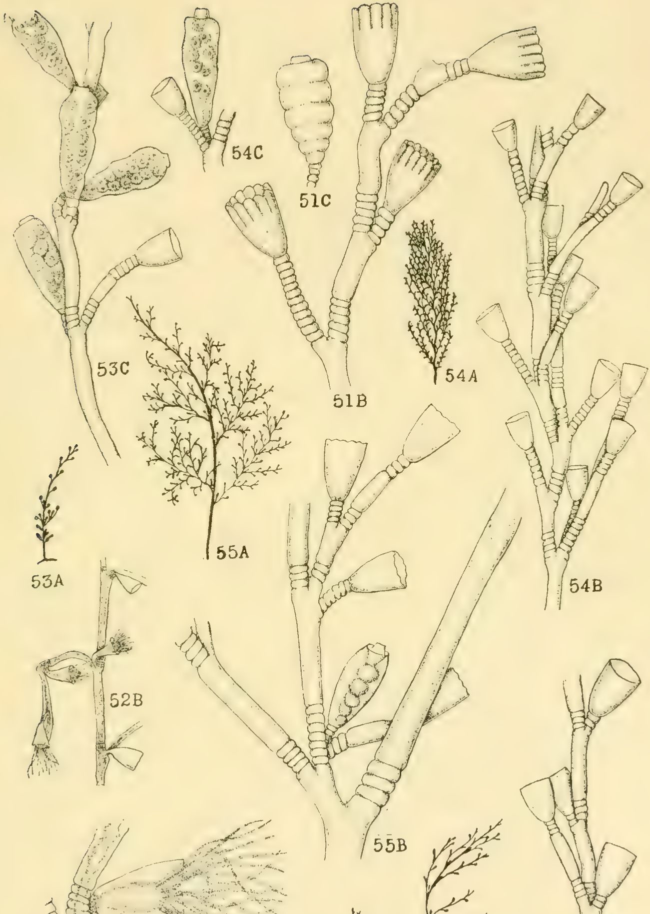


Plate XVII.

Fig. 56. *Obelia multidentata.*

A. Natural size.

B. Portion of stem showing mode of branching and hydrothecæ.

Fig. 57. *Obelia plicata.*

A. Natural size.

B. Portion of stem showing mode of branching and hydrothecæ.

Fig. 58. *Obelia surcularis.*

A. Natural size.

B. Portion of colony showing mode of branching, hydrothecæ and gonophore.

Fig. 59. *Calycella syringa.*

A. Natural size.

B. Hydrothecæ and gonophore (small type).

C. Hydrothecæ (large type).

D. Hydrotheca with long pedicel.

E. Gonophore (large type).

Fig. 60. *Campanulina forskalea.*

A. Natural size.

B. Hydrothecæ and hydranths.

C. Branched colony.

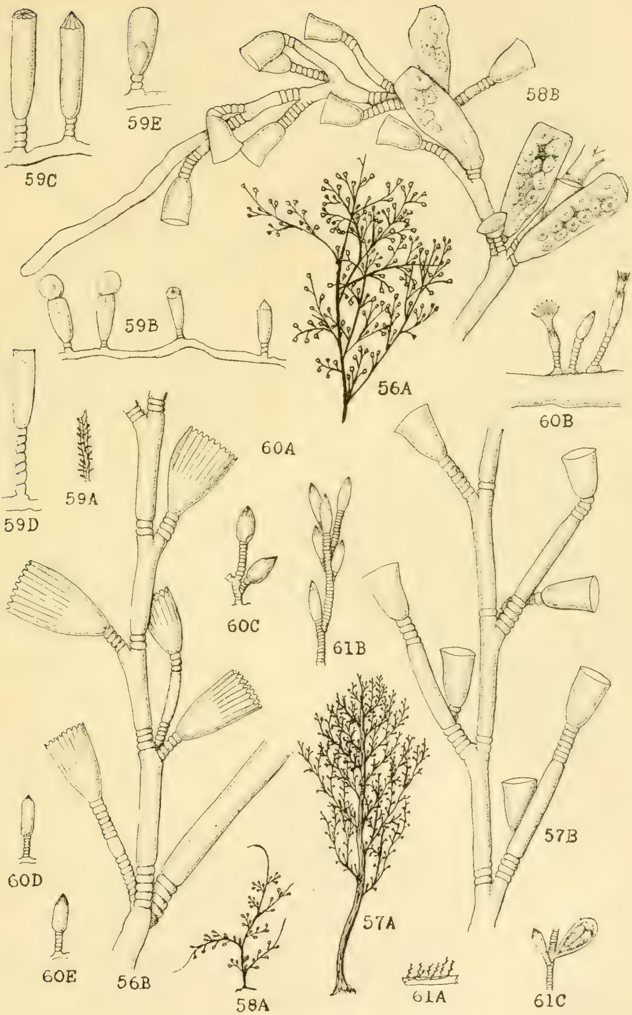
D. E. Hydrothecæ.

Fig. 61. *Campanulina rugosa.*

A. Natural size.

B. Portion of stem showing hydrothecæ.

C. Gonophore.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61C

PLATE XVIII.

FIG. 62. *Cuspidella grandis.*
A. Natural size.
B. C. Hydrothecæ.

FIG. 63. *Cuspidella humilis.*
A. Natural size.
B. Hydrothecæ and hydranth.

FIG. 64. *Lovenella producta.*
A. Natural size.
B. C. D. Hydrothecæ with pedicels.
E. Pedicels with group of thread cells.
F. Group of thread cells further enlarged.

FIG. 65. *Opercularella lacerata.*
A. Natural size.
B. Portion of colony showing mode of branching, hydrothecæ, hydranths and gonophores.

FIG. 66. *Stegopoma plicatile.*
A Natural size.
B. Fascicled stem with hydrothecæ.
C. Terminal portion of branch.

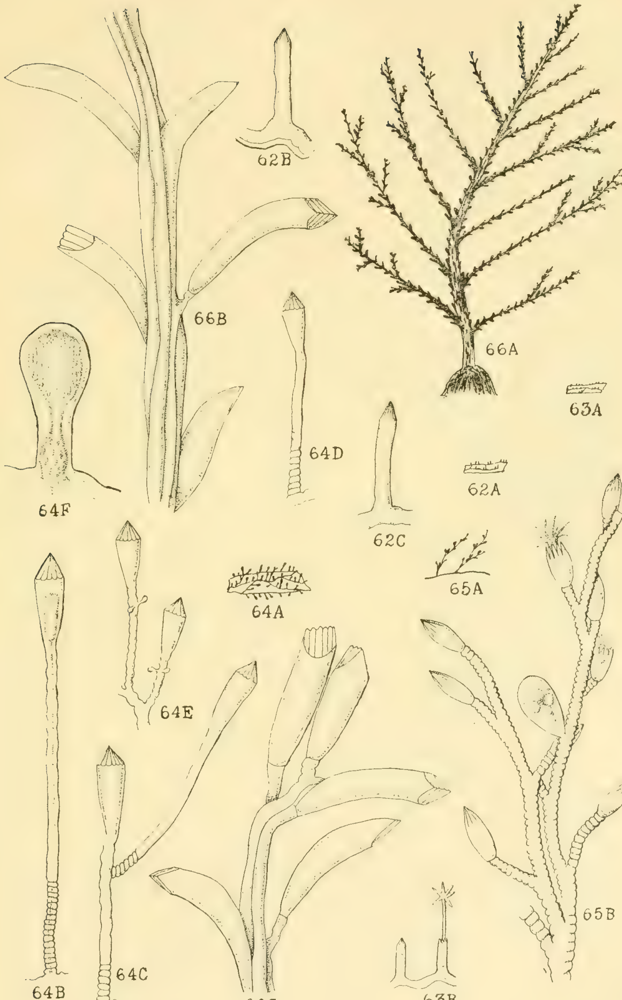
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Plate XIX.

Fig. 67. *Halecium annulatum.*

A. Natural size.

B. Colony showing mode of branching, hydrothecæ, etc.

C. Gonophore (After Torrey).

Fig. 68. *Halecium articulosum.*

A. Natural size.

B. Portion of branch.

C. Gonangium.

Fig. 69. *Halecium corrugatum.*

A. Natural size.

B. Colony showing hydrothecæ and hydranths.

C. D. Gonophores.

Fig. 70. *Halecium densum.*

A. Natural size.

B. Terminal portion of branch.

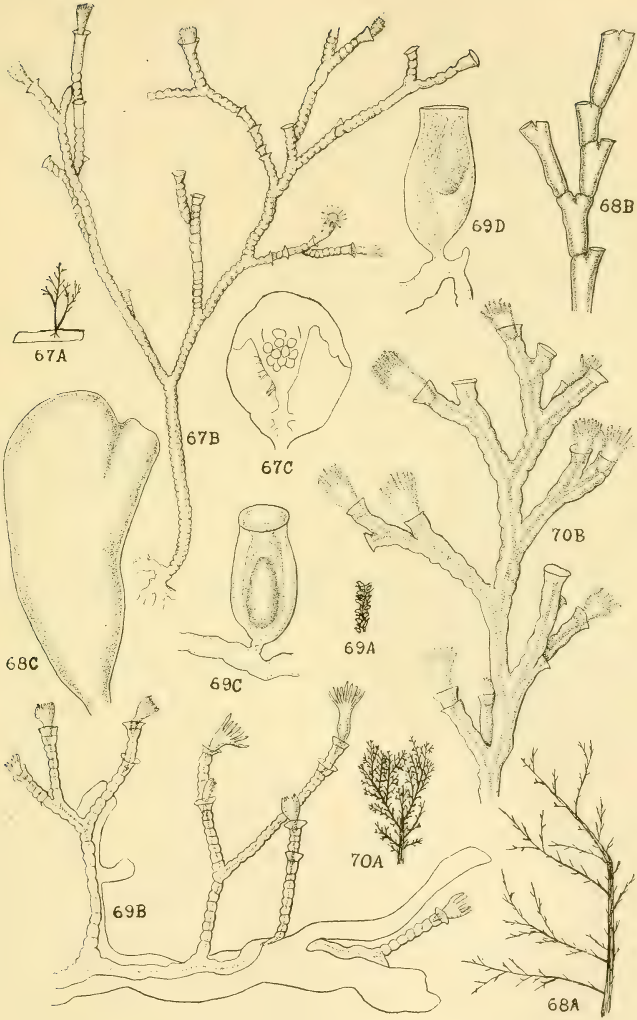
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Plate XX.

Fig. 71. *Halecium flexile.*

A. Natural size.

B. Fascicled stem.

C. Portion of branch showing arrangement of hydrothecæ.

D. Gonophores.

E. Hydranth.

Fig. 72. *Halecium halecinum.*

A. Natural size.

B. Portion of branch showing female gonophores with small terminal hydranths.

C. Portion of branch with malegonophores.

Fig. 73. *Halecium kofoidi.*

A. Portion of stem showing mode of branching, nodes and hydrothecæ (After Torrey).

B Gonophore (After Torrey).

Fig. 74. *Halecium labrosum.*

A. Natural size.

B. Portion of stem showing mode o' l ra hing.

C. Gonophore.

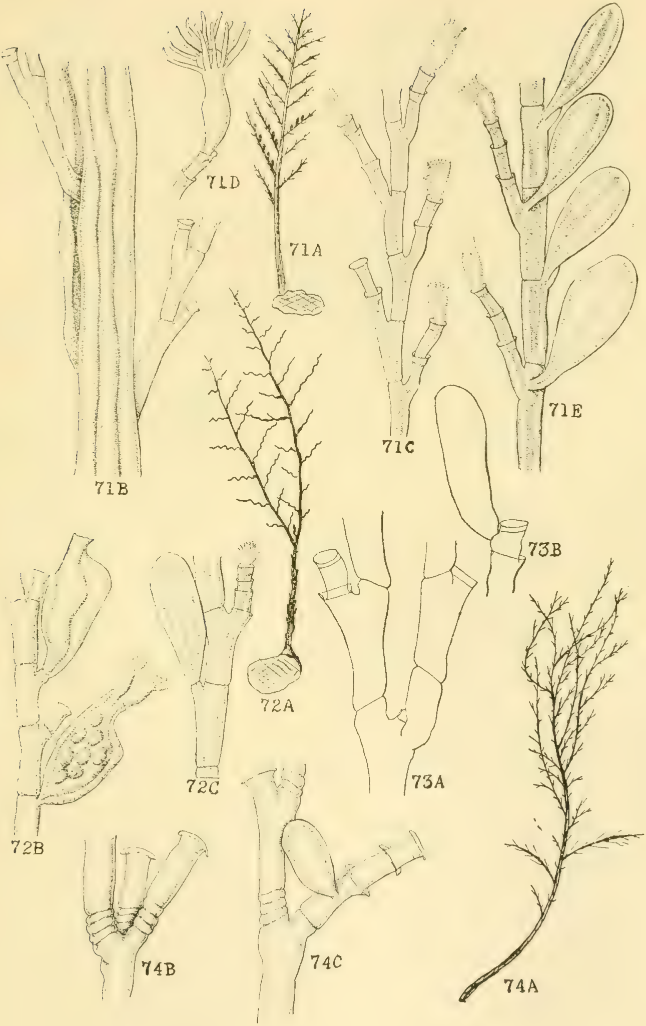
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Plate XXI.

Fig. 75. *Halecium parvulum.*

A. Natural size.

B. Portion of stem showing mode of branching and male gonophores.

C. Female gonophores.

Fig. 76. *Halecium pygmæum.*

A. Natural size.

B. Colony showing branching.

C. Female gonophore.

D. Male gonophores.

Fig. 77. *Halecium reversum.*

A. Natural size.

B. Portion of branch showing position of nodes.

C. Branch rising from fascicled stem.

Fig. 78. *Halecium scutum.*

A. Natural size.

B. Portion of branch showing length of internodes.

C. Gonangium.

Fig. 79. *Halecium tenellum.*

A. Natural size.

B. Colony showing branching.

C. Gonophores (After Nutting).

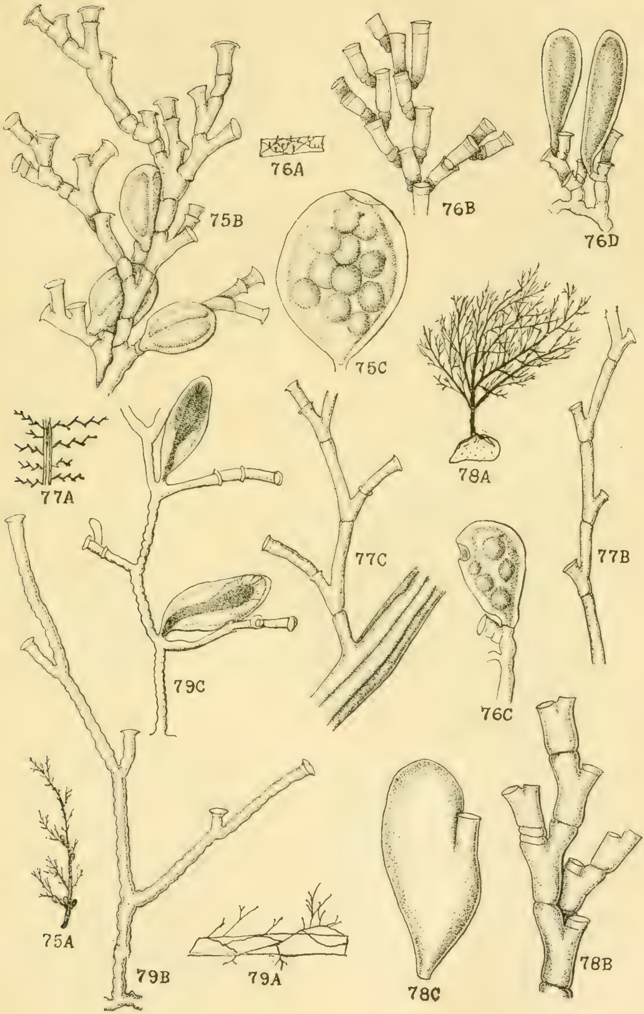
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Plate XXII.

Fig 80. *Halecium washingtoni.*

A. Natural size.

B. Portion of stem showing mode of branching.

C. D. Gonangia (After Nutting).

Fig 81. *Halecium wilsoni.*

A. Natural size.

B. Portion of primary branch showing mode of branching and gonophores.

Fig. 82. *Ophiodes gracilis.*

A. Natural size.

B. C. Portions of stems showing branching and tentacular organs.

D. Hydrotheca with pedicel attached to stolon.

Fig. 83. *Filellum serpens*

A. Natural size.

B. Coppinia mass natural size.

C. Hydrothecæ growing from stolon.

D. Hydrotheca attached to an *Abietinarian* hydrotheca.

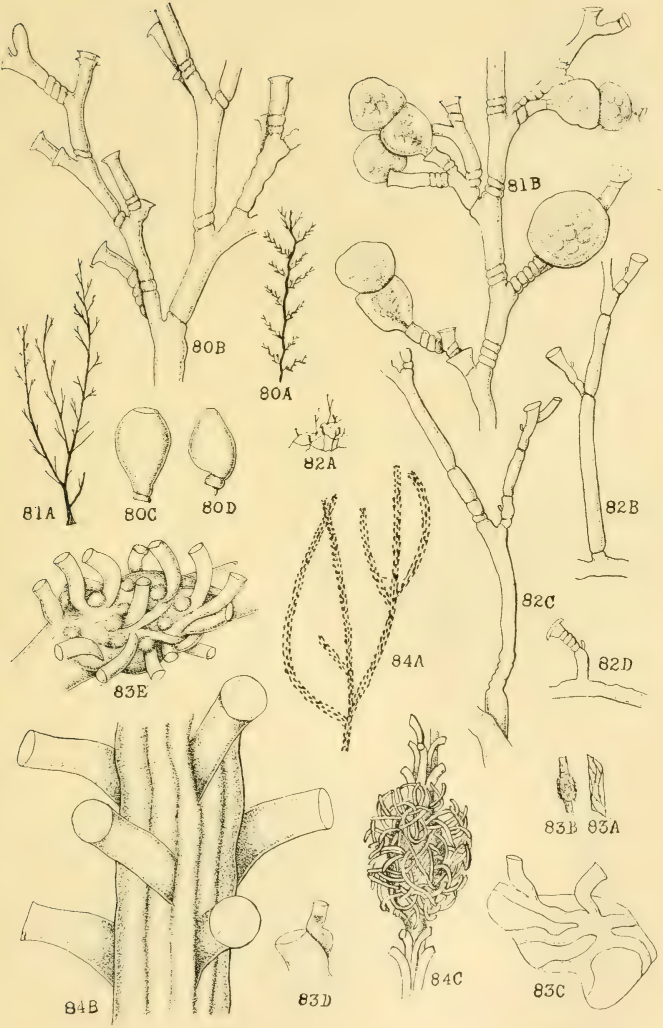
E. Coppinia mass.

Fig 84 *Grammaria abietina.*

A. Natural size.

B. Portion of fascicled stem showing hydrothecæ

C. Coppinia mass (After Bonnevie).


80B
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82A
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83B
83A
83C

PLATE XXIII.

FIG. 85. *Grammaria immersa.*

A. Natural size.
B. Coppinia mass natural size.
C. Portion of fascicled stem showing hydrothecæ.
D. Portion of Coppinia mass.

FIG. 86. *Lafœa dumosa.*

A. Natural size.
B. Coppinia mass natural size
C. Portion of branch of erect stem.
D. Portion of creeping stem.
E. Portion of Coppinia mass

PLATE XXIII.

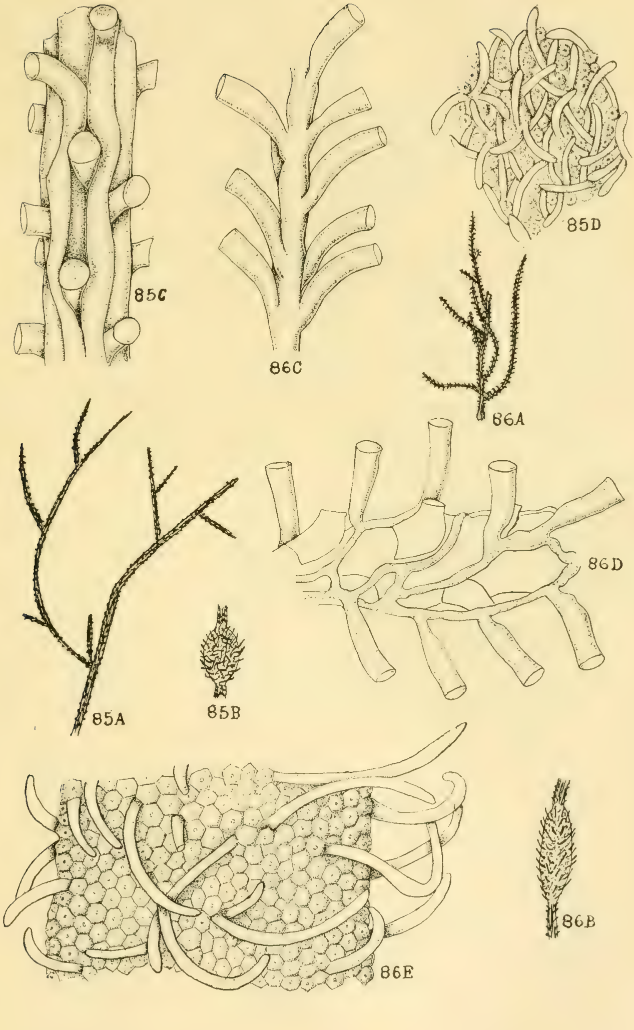


Plate XXIV.

Fig. 87. *Lafœa fruticosa.*

A. Natural size.
B. Portion of branch showing hydrothecæ.
C. Portion of fascicled stem.
D. Coppinia mass (After Bonnevie).
E. Portion of Coppinia mass further enlarged (After Bonnevie).

Fig. 88. *Lafœa gracillima.*

A. Natural size.
B. Coppinia mass natural size.
C. D. E. Portions of stems showing varying size of hydrothecæ
F. Portion of Coppinia mass.

Fig. 89. *Lictorella carolina.*

A. Natural size.
B. Portion of fascicled stem
C. Portion of branch showing hydrothecæ and nematophores
D. Terminus of one portion of fascicled stem.

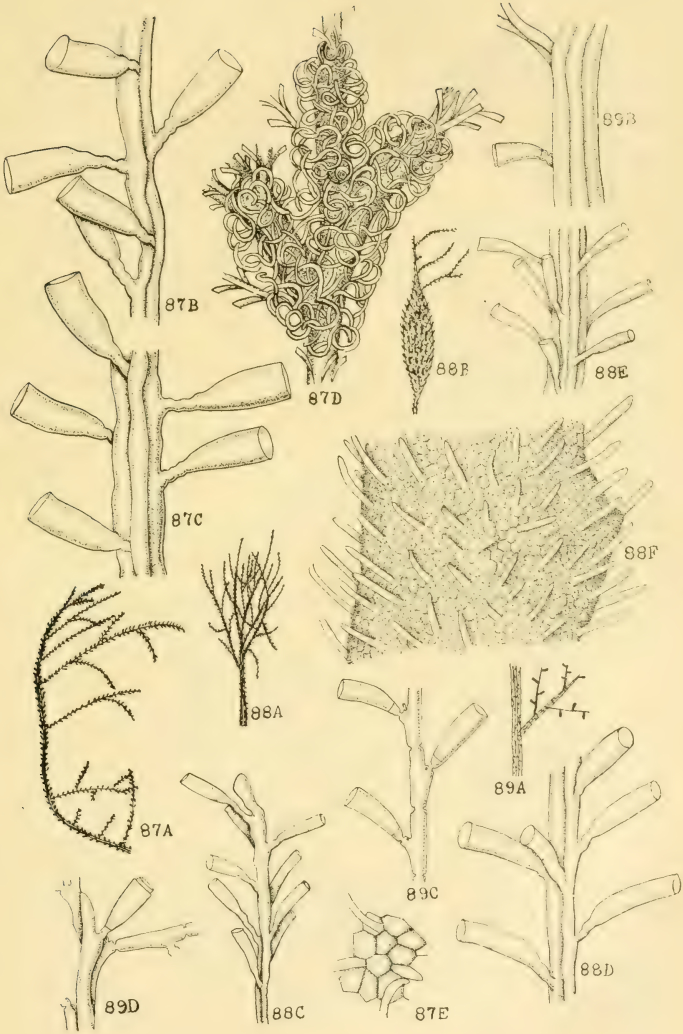

87B
87C
87D
87A
87E
88A
88B
88C
88D
88E
88F
89A
89B
89C
89D

Plate XXV.

Fig 90. *Abietinaria abietina.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. D. Gonangia.

Fig. 91. *Abietinaria amphora.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangia.

Fig. 92. *Abietinaria anguina.*

A. Natural size.

B. Portion of stem showing mode of branching, hydrothecæ and gonangium.

Fig. 93. *Abietinaria filicula.*

A. Natural size.

B. Portion of stem showing mode of branching and hydrothecæ.

C. Gonangium.


92A
90B
92B
91A
90C
93A
93B
90A
91B
91C
93C
90D

Plate XXVI.

Fig. 94. *Abietinaria gigantea.*

A. Natural size.

B. C. Portions of branches showing hydrothecæ and gonangia.

Fig. 95. *Abietinaria gracilis.*

A. Natural size.

B. Portion of stem showing mode of branching and hydrothecæ.

C. Gonangium.

Fig. 96. *Abietinaria greenei.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangia.

D. Gonangium showing acrocyst.

Fig. 97. *Abietinaria rigida.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangia.

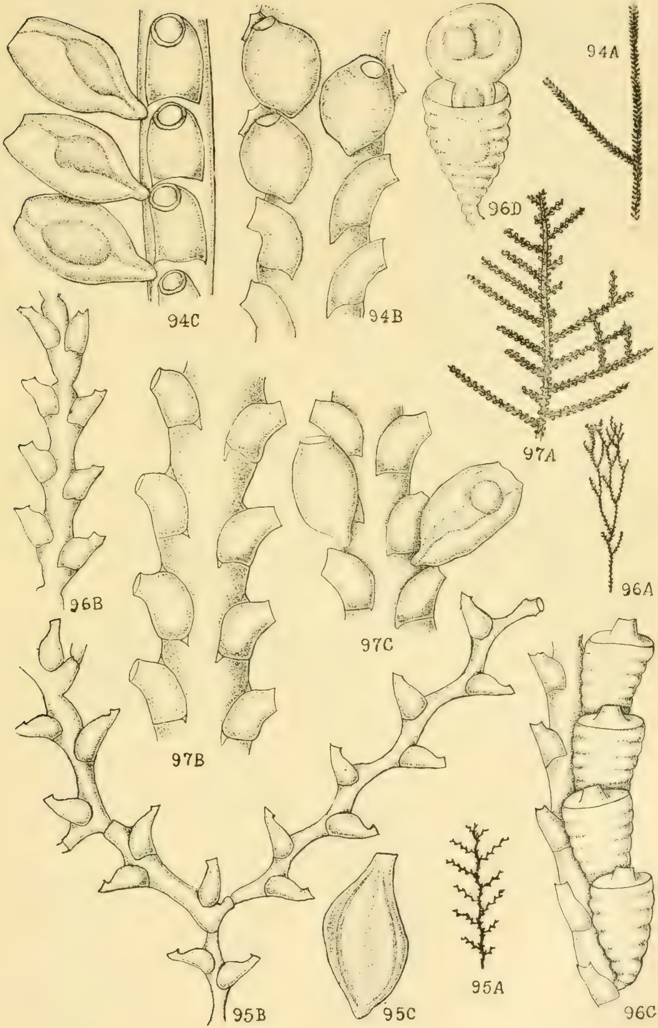

94A
94B
94C
95A
95B
95C
96A
96B
96C
96D
97A
97B
97C

PLATE XXVII.

FIG. 98. *Abietinaria traski.*

A. Natural size.

B. Portion of branch showing hydrothecæ and gonophores.

FIG. 99. *Abietinaria turgida.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangia.

FIG. 100. *Abietinaria variabilis.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangium.

FIG. 101. *Dictyocladium flabellum.*

A. Part of branch showing hydrothecæ (After Nutting).

B. Portion of colony showing mode of branching, hydrothecæ and gonangium.

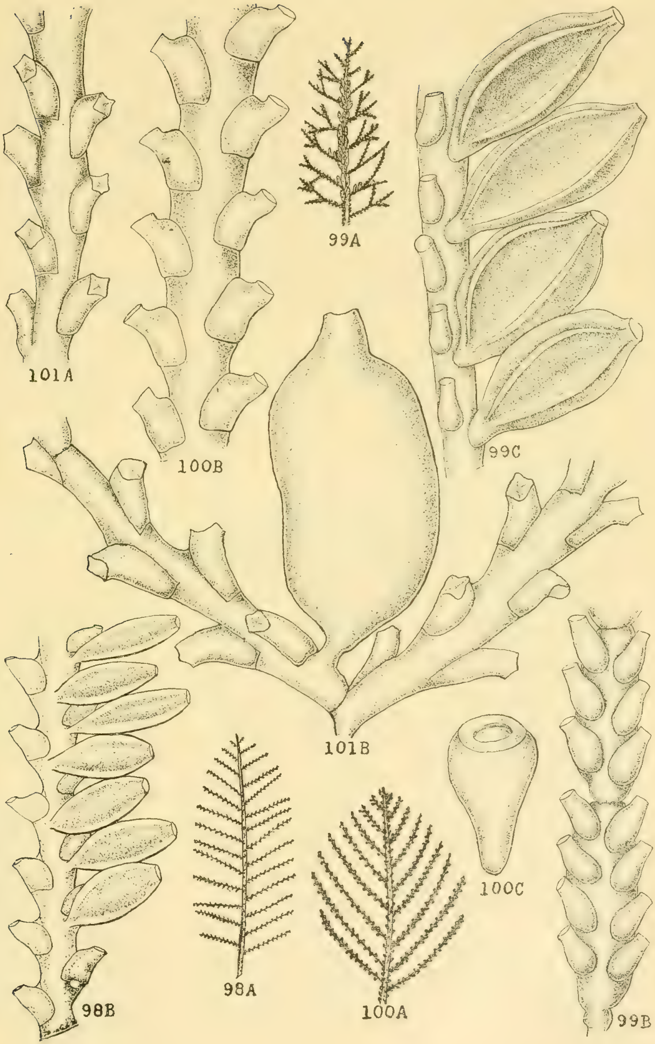

99A
101A
100B
99C
101B
100C
98B
98A
100A
99B

Plate XXVIII.

Fig. 102. *Diphasia pulchra.*
- A. Natural size.
- B. Portion of stem showing branching and hydrothecæ.

Fig. 103. *Hydrallmania distans.*
- A. Natural size.
- B. Portion of branch, side view.
- C. Portion of branch, front view.
- D. Gonangium.

Fig. 104. *Selaginopsis cylindrica.*
- A. Natural size.
- B. Portion of branch with four series of hydrothecæ.
- C. Portion of branch where the fifth and sixth series are intercalated.
- D. Portion of branch with six series of hydrothecæ.

Fig. 105. *Selaginopsis hartlaubi.*
- A. Natural size.
- B. Portion of branch showing arrangement of the hydrothecæ.

Fig. 106. *Selaginopsis mirabilis.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ and gonangium.

Fig. 107. *Selaginopsis pinnata.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.

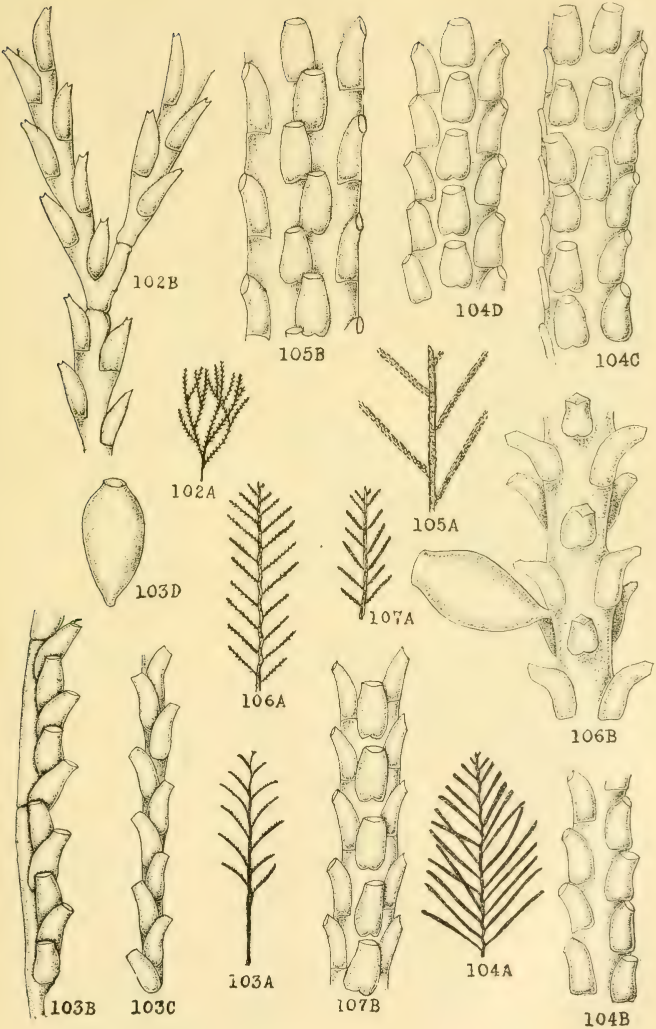

102B
105B
104D
104C
102A
105A
103D
106A
107A
106B
103A
104A
103B
103C
107B
104B

Plate XXIX.

Fig. 108. *Selaginopsis triserialis.*
- A. Natural size.
- B. C. Portions of branches showing arrangement of hydrothecæ.

Fig. 109. *Sertularella albida.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.
- C. Gonangium (After Nutting).

Fig. 110. *Sertularella conica.*
- A. Natural size.
- B. Portion of stem showing hydrothecæ.
- C. Gonophores

Fig. 111. *Sertularella pedrensis.*
- A. Natural size.
- B. Portion of stem showing hydrothecæ.
- C. Gonangium (After Torrey).

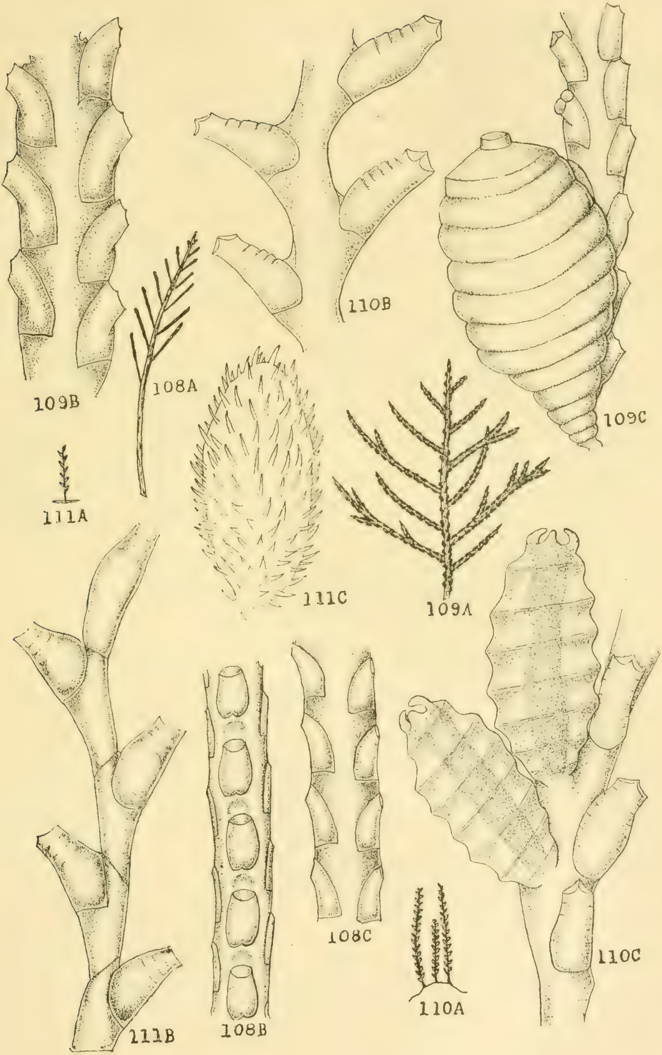

109B
108A
110B
109C
111A
111C
109A
111B
108B
108C
110A
110C

PLATE XXX.

FIG. 112. *Sertularella pinnata.*

A. Natural size.

B. Portion of colony showing mode of branching, hydrothecæ and gonangia.

FIG. 113. *Sertularella polyzonias.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangium.

FIG. 114. *Sertularella rugosa.*

A. Natural size.

B. Portion of stem showing hydrothecæ and gonophore.

C. Gonangium showing teeth.

FIG. 115. *Sertularella tanneri.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

PLATE XXX.

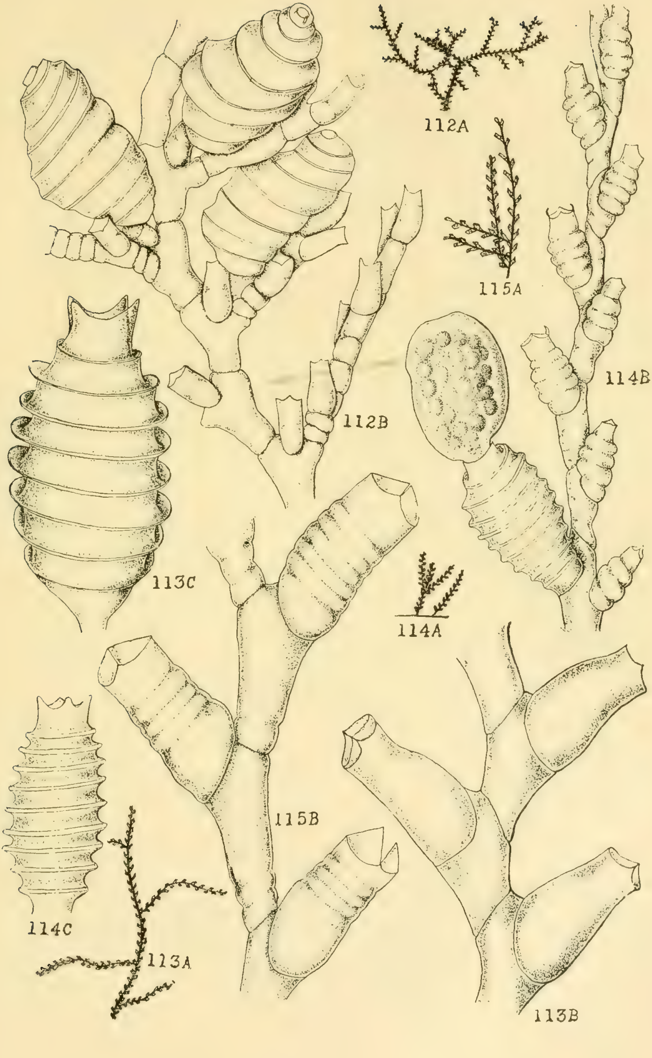


Plate XXXI.

Fig. 116. *Sertularella tenella.*

A. Natural size.

B. Portion of stem showing hydrothecæ.

C. Gonangium (After Hincks).

Fig. 117. *Sertularella tricuspidata.*

A. Natural size.

B. Portion of stem showing branching and hyd othecæ.

C. Much elongated hydrothecæ.

D. Gonangium.

Fig. 118. *Sertularella turgida.*

A. Natural size.

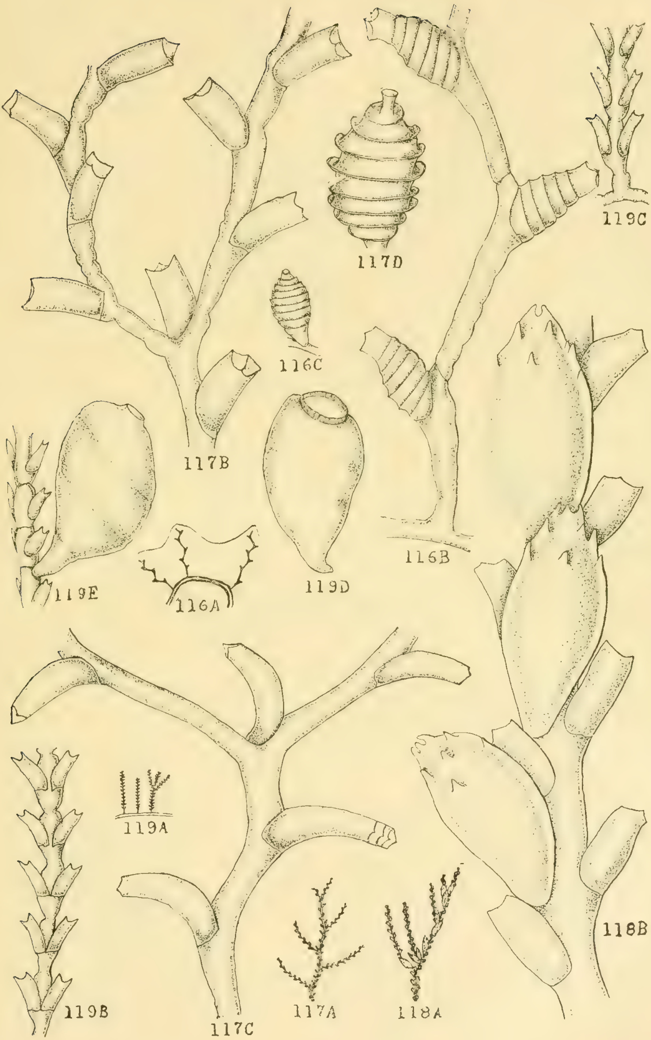
B. Portion of stem showing hydrothecæ and gonangia.

Fig. 119. *Sertularia furcata.*

A. Natural size.

B. C. Portions of stem showing difference in front and back.

D. E. Gonangia.



117D
119C
116C
117B
116B
119E
116A
119D
119A
118B
119B
117A
118A
117C

Plate XXXII.

Fig. 120. *Thuiaria alba.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.
- C. Gonangia.

Fig. 121. *Thuiaria argentea.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.
- C. Gonophores.

Fig. 122. *Thuiaria dalli.*
- A. Natural size.
- B. Portion of stem showing origin of branches.
- C. Portion of branch showing hydrothecæ.
- D. Gonangia.

Fig. 123. *Thuiaria distans.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.

PLATE XXXII.

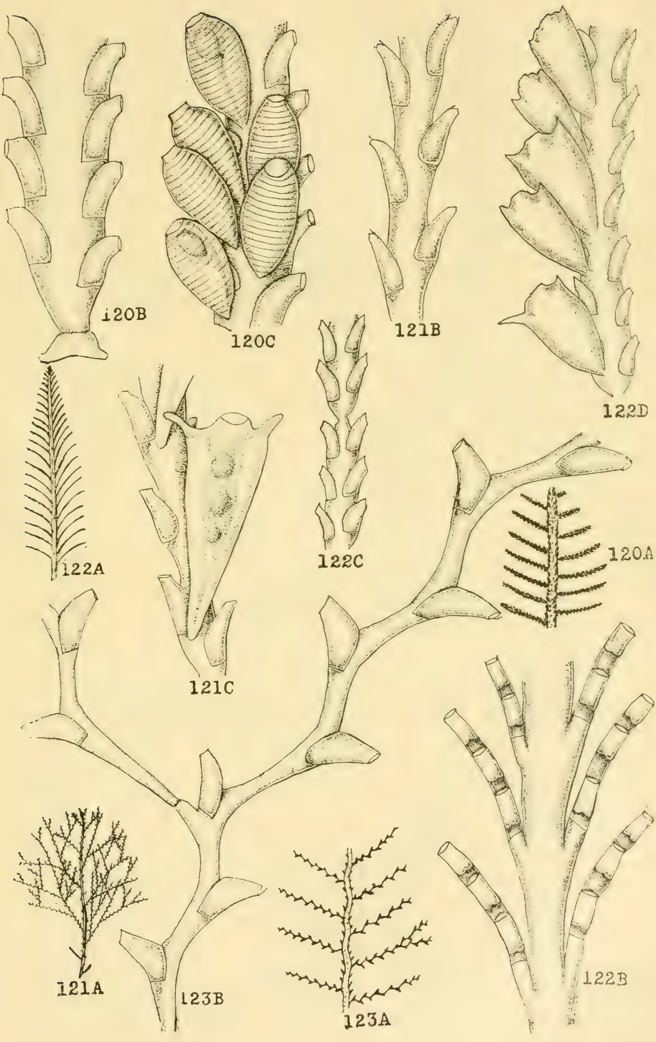


Plate XXXIII.

Fig. 124. *Thuiaria fabricii.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.
- C. Gonophores.

Fig. 125. *Thuiaria robusta.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ.
- C. Gonophores (After Nutting).

Fig. 126. *Thuiaria similis.*
- A. Natural size.
- B. Portion of stem showing mode of branching.
- C. Portion of branch showing hydrothecæ.
- D. Gonangium.

Fig. 127. *Thuiaria tenera.*
- A. Natural size.
- B. Portion of branch showing hydrothecæ and gonophore.

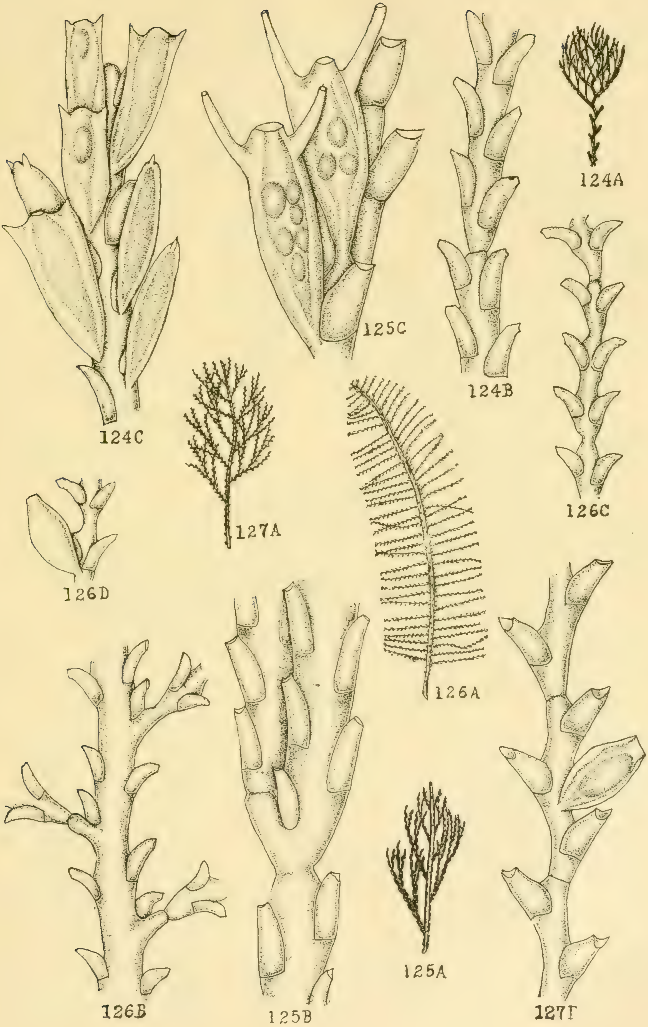

124C
125C
124B
124A
127A
126C
126D
126A
126B
125B
125A
127B

Plate XXXIV.

Fig. 128. *Thuiaria thuiarioides.*

B. Portion of branch showing hydrothecæ.

C. Portion of primary branch to show mode of branching.

D. Gonangium.

Fig. 129. *Thuiaria thuja.*

A. Natural size.

B. Portion of branch showing hydrothecæ.

C. Gonangium.

Fig. 130. *Aglaophenia latirostris.*

A. Portion of hydrocladium showing hydrothecæ (After Nuting).

B. Corbula (After Nutting).

Fig. 131. *Aglaophenia struthionides.*

A. Natural size.

B. Portion of hydrocladium showing hydrothecæ.

PLATE XXXIV.

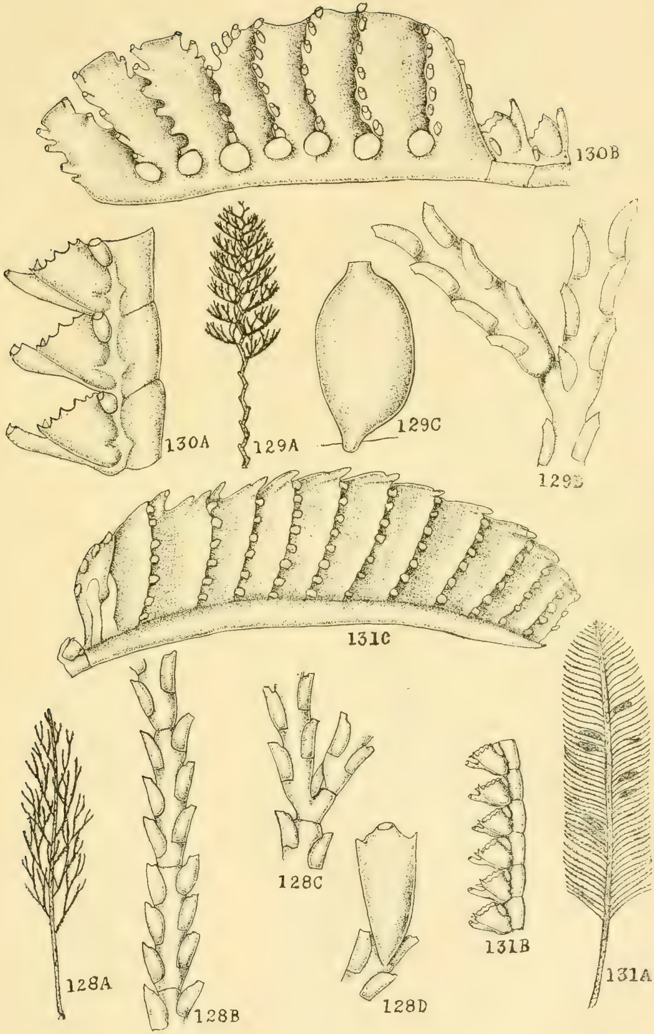


Plate XXXV.

Fig. 132. *Cladocarpus vancouverensis.*

A. Natural size.

B. Portion of hydrocladium showing hydrothecæ.

C. Face view of a hydrotheca.

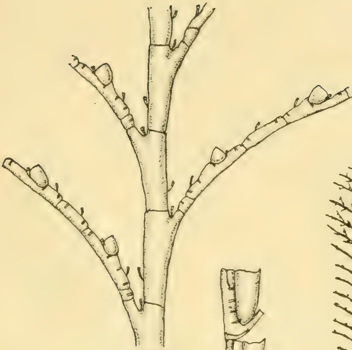
D. Gonophores and phylactogonia.

Fig. 133. *Plumularia corrugata.*

A. Natural size.

B. Portion of stem showing hydrocladia.

C. D. Gonophores, male and female.



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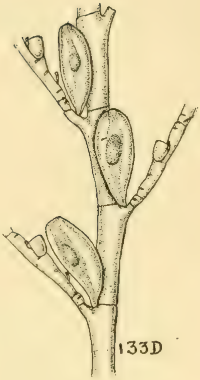
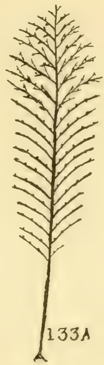


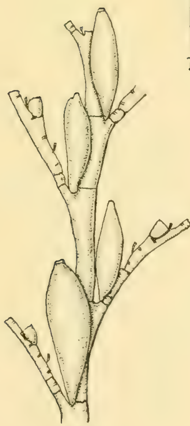
133D



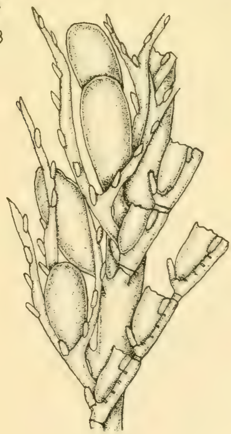
133A

132B

132C



133C



132D

132A

Plate XXXVI.

Fig. 134. *Plumularia goodei.*

A. Natural size.
B. Portion of stem showing two hydrocladia to the internode.
C. Portion of stem showing one hydrocladium to the internode.
D. Gonophores.

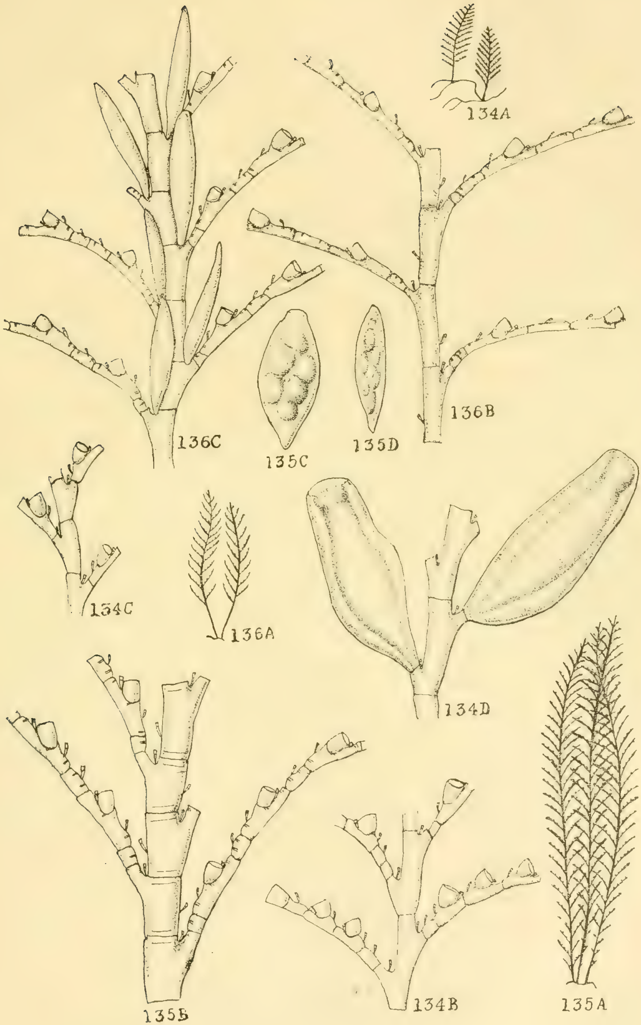
Fig. 135. *Plumularia lagenifera.*

A. Natural size.
B. Portion of stem showing hydrocladia.
C. D. Two views of gonophore.

Fig. 136. *Plumularia setacea.*

A. Natural size.
B. Portion of stem showing hydrocladia.
C. Gonangia.

PLATE XXXVI.



Notes on Some Alaskan Hydroids.

By C. McLEAN FRASER.

Curator of the Pacific Coast Biological Station.

While carrying on investigations on a halibut boat in August 1914, Dr. A. Willey collected a number of marine specimens that came up on the halibut hooks. In the material so collected on August 20, in 50 fathoms, on the halibut grounds southeast of Trinity Islands in the Gulf of Alaska, was a three-ounce bottle of small specimens. As these included a number of hydroids, Dr. Willey kindly placed them at my disposal for examination.

The collection proved to be of considerable interest as it contained specimens of 15 species in which 7 families were represented. The fact that so many species could be obtained so incidentally merely adds strength to the conclusion that the ground must be extremely rich in this particular fauna, as it must be in others as well. Some fine collections have been made off the Alaskan coast but it would seem that little impression has been made if the hydroid fauna can be taken as a basis for judging, since of the 15 species obtained at this time no less than 7 have not been reported previously anywhere in Alaskan waters. These are *Tubularia crocea*, *Halecium tenellum*, *H. washingtoni*, *Ophiodes carchesium*, *Lictorella carolina*, *Abietinaria gracilis* and *Plumularia halecioides*. Of these 7, one, *Ophiodes carchesium*, is described as new and another, *Plumularia halecioides*, has not been previously reported from the west coast of North America.

The large mass of the material consisted of specimens of *Abietinaria abietina*, over which several of the other species were growing, while many others were creeping over bryozoan colonies of which there probably were as many species as there were of the hydroids.

List of species

GYMNOBLASTEA

Family TUBULARIDÆ

Tubularia crocea (Agassiz)

CALYPTOBLASTEA

Family CAMPANULARIDÆ

Campanularia integra MacGillivray

Campanularia verticillata (Linnæus)

Family CAMPANULINIDÆ
Calycella syringa (Linnæus)
Family HALECIDÆ
Halecium tenellum Hincks
Halecium washingtoni Nutting
Ophiodes carchesium n. s.
Family LAFŒIDÆ
Filellum serpens (Hassell)
Lafœa fruticosa Sars
Lafœa gracillima (Alder)
Lictorella carolina Fraser
Family SERTULARIDÆ
Abietinaria abietina (Linnæus)
Abietinaria gracilis Nutting
Sertularella tricuspidata (Alder)
Family PLUMULARIDÆ
Plumularia halecioides Alder.

GYMNOBLASTEA

Family TUBULARIDÆ

Tubularia crocea (Agassiz)

Parypha crocea Agassiz, Cont. Nat. Hist., U.S., vol. IV, 1862, p. 249.
Tubularia crocea Fraser, West Coast Hydroids, 1911, p. 27.

There were but two specimens of this species, one growing on a colony of Bryozoa and the other on *Abietinaria*. The one was a young specimen and of itself would not have been sufficiently developed for diagnosis as it had but 8 proximal and 8 distal tentacles, but it bore sufficient resemblance to the other to leave little doubt that it belonged to the same species. The second one was much farther advanced; but there was no sign of a stolon starting or of any but the one zooid in the colony.

CALYPTOBLASTEA

Family CAMPANULARIDÆ

Campanularia integra MacGillivray

Campanularia integra MacGillivray, Ann. and Mag. Nat. Hist., 3rd ser., XIII, 1842, p. 465.

Campanularia integra Fraser, West Coast Hydroids, 1911, p. 31.

Some specimens of *Abietinaria* were overrun with the stolons of this species but there were but few zooids growing from them. Those that were present were in good condition.

Campanularia verticillata (Linnæus)

Sertularia verticillata Linnæus, Systema Naturæ, 1758, p. 811.
Campanularia verticillata Fraser, West Coast Hydroids, 1911, p. 33.

Two fragments of stems with whorls of hydrothecæ in good condition were the only representatives of this species in the collection.

Family CAMPANULINIDÆ

Calycella syringa (Linnæus)

Sertularia syringa Linnæus, Systema Naturæ, 1767, p. 1311.
Calycella syringa Fraser, West Coast Hydroids, 1911, p. 42.

Two small colonies were found creeping over *Abietinaria*. These corresponded to the pygmy variety of the species.

Family HALECIDÆ

Halecium tenellum Hincks

Halecium tenellum Hincks, Ann. and Mag. Nat. Hist., 3rd ser., VIII, 1861, p. 252.
Halecium tenellum Fraser, West Coast Hydroids, 1911, p. 49.

This species was quite common, occurring on *Abietinaria*, *Lafœa* and on Bryozoa.

Halecium washingtoni Nutting

Halecium geniculatum Nutting, Hydroids of Alaska and Puget Sound, 1899, p. 744.
Halecium washingtoni Fraser, West Coast Hydroids, 1911, p. 50.

Some fine large colonies of this species were obtained as well as some young colonies not yet branched. All of them were growing over *Abietinaria*.

Ophiodes carchesium[1] new species
Fig. 1a and 1b.

Trophosome.—Sub-sessile hydrophores grow directly from a loosely-reticulate stolon, which shows no sign of division into internodes. The hydrophores are large and more campanulate than is usual in the *Halecidæ.* Below the hydrophore there is a sharp constriction which separates the hydrophore from the basal support, which is too short to be properly called a pedicel. The hydranth is large, much greater in diameter than the width of the hydrophore; tentacles 10-12. Tentacular organs appear at intervals along the stolon; the terminal bulb is about twice the diameter of the chitinous cup that surrounds the stalk of the organ.

Gonosome.—Unknown.

Distribution.—Forming a net work over a branching bryozoan colony.

The absence of a regular stem and the shape of the hydrophore readily distinguishes this from other species of *Ophiodes.*

Family LAFŒIDÆ

Filellum serpens (Hassell)

Campanularia serpens Hassell, Trans. Micr. Soc., III, 1852, p. 163.
Filellum serpens Fraser, West Coast Hydroids, 1911, p. 50.

This species occurs in abundance on nearly every specimen of *Abietinaria abietina*, the hydrothecæ being almost as abundant as the *Abietinaria* hydrothecæ in some cases where the creeping stolon forms a network over the whole stem. Many of the hydranths in various states of contraction are very well preserved.

Lafœa fruticosa Sars

Lafœa fruticosa Sars, Norske Hydroider, Vid. Selsk. Forh., 1862, p. 30.
Lafœa fruticosa Fraser, West Coast Hydroids, 1911, p. 52.

A fine large colony of this species was obtained intact.

Lafœa gracillima (Alder)

Campanularia gracillima Alder, Trans. Tynes. Field Club, 1857; p. 39.
Lafœa gracillima Fraser, West Coast Hydroids, 1911, p. 52.

Several small colonies, apparently young, were found on *Abietinaria* and *Lafœa.* No large colonies were obtained.

[1] *Carchesium*, a goblet. Suggested by Dr. Willey as referring to the shape of the hydrophore and support.

Lictorella carolina Fraser

Fig. 2a and 2b

Lictorella carolina Fraser, West Coast Hydroids, 1911, p. 53.

This species was originally described from a fragment in a collection from the San Juan Archipelago. Since than nothing has been seen of the species until on this occasion a fine complete colony was obtained as well as some separate fragments. The complete colony looks much like a colony of *Lafœa gracillima* or at least like certain colonies of that species when the branching has taken place in one plane only. Possibly, if a number of specimens of *L. carolina* were obtained there might be the same variety in it as in *Lafœa gracillima.* The branching has a dichotomous appearance. The main stem, 4 or 5 mm. from the base, divides into two nearly equal branches, which separate rather widely from each other. Each of these branches again but the outer branch is the stronger. Each branches again and this is continued to form a fairly compact but widely spread system of branches. The distance from the base to the end of the ultimate branch in the specimen is 35 mm. The fasciculation which is quite extensive in the basal portion becomes less with each branching until before the ultimate branches are reached there is but the single hydrotheca-bearing stem. To the description of this and of the hydrotheca as originally given, there is nothing special to add unless it is that while in the majority of cases the hydrotheca has the curve which has been described, occasionally it is almost as straight as that of *Lafœa fruticosa*, which it resembles closely.

Family SERTULARIDÆ

Abietinaria abietina (Linnæus)

Sertularia abietina Linnæus, Systema Naturæ, 1758, p. 808.
Abietinaria abietina Fraser, West Coast Hydroids, 1911, p. 57.

As has been previously stated, this species made up the chief bulk of the collection. It is of a very robust type and the colonies are large as well. The majority of the species are much overgrown with other hydroids and with bryozoa. No gonangia were present on any of the colonies.

Abietinaria gracilis Nutting

Abietinaria gracilis Nutting, American Hydroids, Part II, 1904, p. 120.
Abietinaria gracilis Fraser, West Coast Hydroids, p. 61.

One complete colony in good condition of this rather rare species was obtained.

Sertularella tricuspidata (Alder)

Sertularia tricuspidata Alder, Ann. and Mag. Nat. Hist., 2nd ser., XVIII, 1856, p. 356.

Sertularella tricuspidata Fraser, West Coast Hydroids, 1911, p. 71.

Several fragments of this ubiquitous form were present,—some with gonangia.

Family PLUMULARIDÆ

Plumularia halecioides Alder

Fig. 3.

Plumularia halecioides Alder, Ann. and Mag. Nat. Hist., 3rd ser., III, 1859, p. 353.

Plumularia halecioides Hincks, British Hydroid Zoophytes, 1868, p. 306.

There was but one plumularian colony in the collection and it was a young one. As it was not old enough to be branched or fascicled it has not all the characteristics of a mature colony of *P. halecioides*, but in other respects it answers the description of the species very well.

The total length of the colony is less than 3 mm. and as it is unbranched, it resembles a hydrocladium more than a complete colony. The basal internode is without a nematophore and without a hydrotheca. Following this are three hydrothecate internodes, with two intermediate internodes. The hydrothecate internodes, especially the proximal one, are much longer than the intermediate. The hydrotheca is situated near the distal end of the internode, is nearly equal in breadth and height and is but slightly flaring if at all. There is a nematophore near the proximal end of each hydrothecate internode and two just above or beside the upper part of the hydrotheca and one on each intermediate internode. There is no sign of interseptal ridges.

Note.—A complete synonymy for each species as far as west coast references are concerned as well as a Bibliography has been given in the 1911 paper on "West Coast Hydroids" and it does not seem necessary to repeat these here.

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SECTION IV

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On the Nervous System of the Larva of Sphida Obliqua Walker.

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INTRODUCTION.

In this paper it is proposed to describe the entire nervous system of the full-grown larva of *Sphida obliqua* Wlk., tracing the distribution of the various ganglia, nerves, and their branches as far as they have been followed.

This caterpillar is well adapted for dissection because of its comparatively large size, the paucity of hairs on the body, and the relative ease of obtaining a sufficiently large number of specimens for dissection. It is found in the stem of the common broad-leaved cattail reed (*Typha latifolia L.*) which grows abundantly in the swamps in the neighbourhood of Ste. Anne de Bellevue and on Ile Perrot. The larva pupates at the end of April and imagination takes place a few days past the middle of May. The eggs are laid at this time and soon hatch, the larvae feeding inside the stem of the plant near its roots. Full grown caterpillars may be collected late in the fall, just before hibernation.

At this time the insect is about 50 mm. long. The head is comparatively small, flat and strongly chitinized, these qualities rendering it rather difficult to dissect. There are six ocelli on each side of the head. The body is nearly cylindrical and of a neutral shade. There are eight distinct abdominal segments, and of these the third, fourth, fifth, sixth and eighth bear prolegs. Spiracles are borne on the prothoracic and on each of the eight abdominal segments.

The nervous system of the larva is rather generalized; there is a ganglion for each of the first nine body segments. In the tenth segment, however, there is a fusion of at least two ganglia. The

central nervous system consists of the supra-oesophageal ganglion or brain and the ventral chain. The latter is situated along the median line of the venter, above the ventral muscles. The first ganglion of the ventral chain (the sub-oesophageal ganglion) is joined to the brain by a pair of connectives which pass around the oesophagus, so that the entire nervous system is composed of a chain of ganglia giving off nerves, each ganglion connected with the one on either side of it by a pair of connectives.

In describing the central system below, the ganglia and nerves situated in the head will first be described, then those of the thorax and lastly, those of the abdomen. The sympathetic systems will be described separately.

Acknowledgments. To Mr. J. M. Swaine of the Division of Entomology, Ottawa, at whose suggestion this investigation was undertaken, I am indebted for valuable hints as regards methods, given me at the inception of the work. I also wish to express my gratitude to Professor William Lochhead for his generosity in placing at my disposal his library and the splendid equipment of the Biological laboratories of Macdonald College, and to Professor A. D. MacGillivary of the University of Illinois, for kindly reading this paper in manuscript and making several valuable suggestions.

Methods.

The plants containing the caterpillars were cut off about nine inches above the ground in the late fall, and the lower portions dug up, brought indoors and planted in wet sand. The caterpillars were removed as needed. Several specimens were also preserved in 5% chloral hydrate.

The usual methods of dissection were followed. The insect was first etherized, then cut along the median line of the dorsum and pinned under water in a small dissecting tray. The pins were then cut off close to the insect in order that they might not interfere with the free manipulation of the dissecting instruments. The abundance of adipose tissue is a great hindrance in dissecting and to remove it without breaking the nerves required careful and patient manipulation.

On account of the transparency of the fresh tissues it was found necessary to fix or stain the material before tracing the course of the nerves.

Fixing. Gilson's alcoholic sublimate gave good differentiation but was not found convenient for use in dissecting on account of the corrosive action of the mercuric chloride on metals.

Picro-formol (P. Bouin) was used with good results as it fixes and stains rapidly. The formula of this fixing agent is:—

Picric acid, sat. aq. solution.......	75 parts,
Formalin........................	25 "
Acetic acid......................	5 "

Maceration. For a study of the peripheral nerves it was found advantageous to macerate in distilled water for several days, or in dilute nitric acid for a shorter time. The muscular tissue could then be teased out, leaving the integument and its nerves exposed, the latter being more resistant than the muscles to the macerating action of the water. Specimens thus treated were always hardened afterwards in picro-formol.

Staining. Several stains were tried with varying success. A weak solution of Delafield's haematoxylin gave fair results but did not prove satisfactory for the finer details. The only really satisfactory stains of the nervous tissue were obtained with methylen blue. The strength used was $\cdot 5\%$ in physiological salt solution. In most cases where fresh specimens were used the nerves were stained *intra vitam*. About 2 cc. of the staining solution were injected into the living caterpillar. In from thirty to sixty minutes the insect was etherized and opened in the usual manner. On opening the caterpillar it was usually found that the nerves were not uniformly stained. Indeed it was extremely difficult ever to obtain a perfect stain of all the nerve tissues. Ehrlich who first used the *intra-vitam* method of staining nervous tissue, pointed out that the sensory nerves were stained while the motor nerves remained colourless. The motor nerves however will also stain if given sufficient time. The same worker also states that methylen blue, in contact with reducing agents in alkaline solution, is reduced to its colourless leucobase. Because of this, tissues, after they have obtained their maximum degree of coloration, lose the blue colour rapidly. These statements explain the difficulty of obtaining a perfect stain.

In several cases the caterpillar was killed and pinned before staining. The stain was poured on the insect in the dissecting dish and left for half an hour or longer. As long as the tissues were fresh, I obtained a stain equally as good as by Ehrlich's *intra-vitam* method. Indeed no advantage could be observed in the latter method over the staining of the dead but fresh tissue. This holds good both for material sectioned and for that stained for dissection.

Specimens stained in methylen blue lost their colour very readily in water and it was found necessary to permanently fix the blue colour in the tissues. The method used was that devised by Bethe

for histological work. The fixing agent was a solution of ammonium molybdate made up according to the following formula.

Ammonium molybdate	1	gm.
Distilled water	10	"
Hydrogen peroxide	·5	"

A drop of hydrochloric acid is added to the solution and a precipate of molybdic acid forms, but readily redissolves on agitation. To prevent maceration, a few drops of a 1% osmic acid solution were added to the above mixture, and also to the water in which the dissection was carried out. The tissues of the stained caterpillar were bathed in physiological salt solution, and the freshly made fixing solution, cooled to near zero, was then poured on and left for several hours. Material thus fixed remained in water indefinitely without losing its colour.

Preserved Specimens. During the winter months preserved specimens were used after the fresh material was exhausted. Chloral hydrate was used as the preservative and it proved an excellent medium for preserving the internal organs. The finest nerves were found to be in good condition after months of preservation. The entire lateral sympathetic system was traced in preserved material.

The dissection of preserved material is somewhat less difficult than that of fresh material as in the former the muscles and fat body have shrunken considerably.

While it has been held by most workers that nervous tissue will not take the methylen blue stain unless living or freshly killed, I have succeeded in obtaining fairly satisfactory stains with preserved material. The stain is of course much more difficult to obtain than with fresh material and, when obtained, is not as good. Material thus stained was not sectioned, and it is doubtful whether good results would be obtained in histological work, but stained for dissection the nerves were well differentiated from the other tissues. Some of the most difficult nerves were traced in preserved specimens after first staining with methylen blue and fixing with ammonium molybdate.

The Central Nervous System.

1. The Cephalic Ganglia and Nerves.

The Supra-Oesophageal Ganglion. (Figs. 1 and 5, B.B.). The brain consists of two large ovoid masses which show no differentiation into neuromeres. This ganglion is situated in the dorsal

portion of the head, immediately above the oesophagus (figs. 1, 3 and 7, OE.) and just behind the anterior end of the dorsal vessel (figs. 3 and 7, Ao.) which passes between the oesophagus and the brain.

The two ovoid ganglia are joined at one side of their bases, the apices, (from which the nerves arise), projecting obliquely forward so that the anterior margin of the brain has somewhat the appearance of an inverted ogee arch, while the posterior margin is bi-lobed. The ventral side of the brain is somewhat concave owing to its position on the oesophagus. The commissure between the two halves of the brain has disappeared, but where the two ganglia have grown together there is a distinct linear depression which serves as a line of demarcation between them.

From the supra-oesophageal ganglion the following pairs of nerves originate. (1) The optic nerves, (2) the antennal nerve, (3) the arched and clypeo-labral nerves, (4) the crura cerebri, (5) occasionally, the accessory commissure, and (6) the two pairs of nerves which connect the lateral ganglia with the brain. The last and the arched nerve will be described under the sympathetic system.

The Optic Nerve. (Fig. 3, O.N.) This nerve arises as a large nerve trunk from the lateral edge of the anterior border of the supra-oesophageal ganglion. It runs obliquely forward unbranched, passing above the flexor muscles of the mandibles. It then bends downwards until it reaches the wall of the head between the third and fourth ocelli. Here the nerve divides, one branch running forward along the wall of the head, the other running backward. From each of these branches three short stout nerves (fig. 3, oc.) are given off, one going to each of the ocelli.

The Antennal Nerve (figs. 1 and 3, A.N.) arises inside the origin of the optic nerve. This nerve is quite stout but not as large as the optic nerve. It runs side by side with the latter unbranched until it reaches the tentorium. In front of the tentorium it gives off two minute branches (*a*) which innervate one of the antennal muscles. Branch *b* is given off in front of branch *a*. This runs toward the side of the head innervating the seta situated just behind the antenna. The third branch *c* is a small nerve running towards the centre of the head and innervating antennal muscles. After giving off branch *c*, the antennal nerve enters a pear-shaped sac which projects into the antenna. Branch *d* is given off shortly after the nerve enters the sac, and a fifth branch arises farther in. The main branch of the nerve continues into the end of the antenna.

The Clypeo-Labral Nerve. (Fig. 3, C.L.) This nerve originates, in connection with the arched nerve (Ar.), from the brain just above

the crus. From its origin the common nerve trunk curves outward and forward and then inward. The two nerves then separate, the clypeo-labral running forward to innervate the clypeus and labrum. In front of the point of separation the proximal branch *a* is given off from the ventral surface of the nerve. This branch runs around the oesophagus and on the ventral side projects forward to the base of the labium. Branch *b* goes inward to the large elevator muscles of the labrum, also sending a branch to the pharyngeal muscles. Branch *c* is given off immediately anterior to *b*. It too runs inward, entering a minute ganglion-like enlargement (*gl*) of the frontal nerve of the median sympathetic system. The clypeo-labral nerve bends a little outwards at the origin of branches *b* and *c* and runs forwards toward the anterior end of the head. The fourth branch *d* innervates the base of the clypeus. Branches *e* and *f* innervate the flexor muscles of the labrum. The next branch originates distad of *f*, and divides into three nerves which innervate the lateral portion of the labrum. The eighth branch curves inward, and running back a short distance, it bifurcates, the two branches going to the posterior portion of the labrum. Branch *k* also runs inward and bifurcates, innervating certain of the labral muscles. The clypeo-labral nerve then continues its course to the anterior portion of the labrum where it divides into several branches.

The Crura Cerebri (Figs. 3, 4 and 7, Cr.) These are two stout connectives which are given off from the ventral side of the supra-oesophageal ganglion just behind the origin of the foregoing nerves. They run around the oesophagus and enter the anterior lateral borders of the sub-oesophageal ganglion.

Together with the ganglia which they connect, the crura cerebri form the so-called oesophageal ring (fig. 7).

The Accessory Commissure. (Figs. 7 and 8, sc.). This is a Commissure which passes beneath the oesophagus and connects the two crura. From the middle point a branch is given off which runs forward along the median line of the ventral surface of the oesophagus. This branch soon bifurcates, sending nerves to two long labial muscles which lie beneath the oesophagus.

The origin of this Commissure varied considerably in the material examined. In most cases it arose from the crus near the ventral surface of the oesophagus; in a few cases it originated from the brain close to the origin of the crus; and in other specimens it arose from the crus at any point intermediate between the two points of origination mentioned above. Hammar describes it in the larva of *Corydalis cornuta* L. as connecting the lower portions of the crura, and, as just stated, I found this to be true in the larva of *Sphida obliqua* in the

majority of cases. This same writer also names several insects, (mentioned by Kolbe) in which this cross-nerve originates from a similar point. In the larva of the *Sphinx ligustri* L. however, according to Newport, and in the majority of cases for which this nerve has been described it originates from the brain.

This nerve has been described for only a limited number of insects, but, as Henneguy says, "*elle doit se retrouver chez d'autres, mais elle est très difficile a desséquer et à mettre en évidence.*" It was first described for Crustacea by Audouin and Milne-Edwards in 1828. At the time it was thought rather exceptional but the work of many anatomists soon proved that it was also found in many insects and its presence is now accepted as a general rule.

No definite agreement seems to have been reached as to what name should be given to this nerve. Several names have been used by various writers, but none of them has been entirely satisfactory. Some of the names most commonly used are, *transverse commissure of the oesophageal ring, les connexions transversales des commissures oesophagiennes, commissure transversale* and *suboesophageal commissure.* Hammar, '08, adopts the term *suboesophageal commissure,* pointing out that the other terms used are applicable only to a limited number of cases. While this term is perhaps the most satisfactory in general usage, and it is descriptive of the condition such as is found in the *Corydalis larva* or in *Sphida obliqua,* it is however open to the same objection as the other terms, because, as stated above, in the majority of cases described, the nerve arises from the brain and passes *around* the oesophagus. I have therefore used the term *accessory commissure.* I believe that this term is applicable to all cases, and is descriptive of the commissure in question as it distinguishes it from the main commissures of the head, viz., the crura and the transverse commissures which connect the ganglia that have fused in the formation of the brain.

THE SUBOESOPHAGEAL GANGLION (Figs. 4, 7 and 8, S.G.). This is a large, somewhat egg-shaped ganglion situated beneath the oesophagus in the posterior portion of the head, and connected with the supraoesophageal ganglion by means of the crura cerebri as stated above.

In this ganglion and the others of the ventral chain there is no trace of commissures,[1] and the only indication of the duplicate chain

[1]Throughout this paper the term *commissure* is reserved for the transverse connections between corresponding ganglia of the primitively double nervous chain, while *connective* denotes the longitudinal connections between the ganglia of adjacent segments. This uasge is in accordance with the suggestion of Yung, '78, and has been adopted by Hammar and other writers. Dr. A. D. MacGillivray has however suggested that the use of *commissure* has become so fixed in zoology as applying to both transverse and longitudinal connections that it will be difficult to change it.

lies in the fact that in the thorax the first pair of connectives are quite separate and the second and third pairs are united for a very short distance, while in the abdomen the connectives, which are united throughout the greater part of their course, separate shortly before entering the posterior ganglion.

The mandibles, maxillae, labium and the anterior portions of the silk glands are innervated by the suboesophageal ganglion. The description of the nerves of this ganglion follows.

The Mandibular Nerve (Fig. 4, Md.). This is the largest nerve of the suboesophageal ganglion as might be expected from the fact that the mandibular muscles are the largest and most numerous in the head. It is given off from the anterior border of the ganglion, inside of the insertion of the crus. It runs forward, beneath the pharynx for a short distance. Emerging from beneath the pharynx, it runs towards the back of the head and then bends outwards passing beneath the dorsal layer of the large adductor muscles of the mandible. It then turns backwards, its branches ramifying among the mandibular muscles.

The mandibular nerve gives off a large number of branches, the chief of which are described below.

Branch *a* is given off a short distance from the origin, and projects forward beneath the pharynx, terminating near the base of the labium. It gives off two branches which go to muscles of the labium. Branch *b* originates back of the tentorium and partially innervates the large adductor muscle of the mandible. The third branch *c* arises nearly opposite to *b*. It extends forward entering the base of the mandible where it innervates certain small muscles. The next branch *d* also extends forward into the mandible where it divides into several branches. Shortly after giving off *d* the mandibular nerve bifurcates, the branches (*e* and *f*) both run back to the base of the mandibular muscles near the neck of the insect. The two branches run parallel to each other, *e* above *f*, with a layer of muscle interposed between them. They both give off numerous branches, as shown in fig 4, which ramify among the mandibular muscles.

The Maxillary Nerve (fig. 4, Mx.) arises from the ventral side of the anterior end of the ganglion and runs forward, innervating the maxilla and its muscles.

The proximal branch *a* soon bifurcates innervating certain of the maxillary muscles. It is also connected with branch *r* of the lateral sympathetic system. Branch *b* runs obliquely towards the integument where it terminates in a minute ganglion from which several small sensory nerves arise. Distad of the origin of *b* four branches *c* are given off close to each other and all innervate maxillary muscles.

The nerve continues forward and near the base of the maxilla gives off branch *d* which runs laterally and bifurcates, branch *1* runs to the base of the maxilla where it branches profusely, innervating the integument; branch *2* curves backward, receives nerve *r* of the lateral sympathetic system, and then divides into two nerves which innervate maxillary muscles. The maxillary nerve, after giving off branch *d* enters the maxilla and gives off a large number of branches which go to the muscles and sense organs.

The Labial Nerve (fig. 4, Lb.) originates near the middle of the anterior ventral surface of the ganglion and somewhat behind the origin of the maxillary nerves. At a short distance from its origin it sends out two branches; the proximal one *a* goes to the depressor muscles of the labium; the second goes to the integument where it divides into several branches. Branch *c* is quite stout and runs forward, parallel and very close to the main nerve. It sends nerves *1*, *2* and *4* inward to the silk glands; nerve *3* goes to Fillipi's glands, which are situated a short distance behind the union of the two silk glands. After giving off branch *3*, nerve *c* continues forward for a short distance and then divides into two nerves, *m* and *n*. Near the point of division, nerve *n* sends a minute nerve *x* across connecting with the corresponding nerve of the other side. This cross-nerve passes above the silk glands and lies immediately behind their point of union. Nerves *m* and *n* terminate in the muscles of the labium.

The fourth branch *d* of the labial nerve originates at a short distance in front of the origin of *c* and runs forward to the integument where it innervates a seta on the under side of the labium. Continuing forward, the two labial nerves are conneected by a small cross-nerve *y*. This nerve passes on the ventral side of the silk glands and in front of the point where the two glands enter the common duct. Two branches, *5* and *6*, are given off from the cross-nerve near its origin on either side and run back innervating labial muscles. From the middle of the cross-nerve a single unpaired nerve, 7, is given off, and this runs directly to the ventral integument.

The farther branches of the labial nerve in the anterior portion of the labium are,—*e* and *f*, which go to the muscles of the spinneret, *g*, which goes to the integument at the base of the palpus, and *h* which has been traced to the base of the palpus, and which probably innervates this organ.

The Ventral Nerve. (Fig. 4, L.) The ventral nerve of the suboesophageal ganglion arises from the lateral border of the ganglion and runs outward and slightly backward toward the base of the head. About 2 mm. from its origin it divides into two branches *a* and *b*.

The anterior branch *a* soon forks again; *1* goes to the wall of the head immediately cephalad of the conjunctiva; *2* runs along the conjunctiva between the head and the prothorax and sends off several minute branches to the integument. Branch *b* is situated in the anterior portion of the first thoracic segment; it gives off three secondary branches as shown in fig. 4. These branches seem to innervate the anterior portions of the longitudinal muscles of the prothorax.

2. THE THORACIC GANGLIA AND NERVES.

There are three ganglia in the thorax, one situated in the anterior portion of each segment immediately above the ventral muscles. These three ganglia are similar in appearance, especially those of the meso- and meta-thoracic segments. The ganglia are broadly ovate, in some cases nearly globular. The size is about ·7 x ·5 mm. The pro-thoracic ganglion is joined to the suboesophageal ganglion by a pair of short straight connectives about ·4 mm. long. These connectives are free throughout their entire course. The connectives between the pro- and meso-thoracic ganglia and those between the meso- and meta-thoracic ganglia are about 2·8 mm. long. They are united for one-eighth or one-sixth of the distance from the anterior ganglion, and then diverge gradually, continuing their course separately until they enter the anterior borders of the next ganglion. The two separated connectives enclose between them a lance-shaped space within which the diagonal muscles (fig. 1, dm.) cross each other near their point of insertion. The median nerve of the ventral sympathetic system leaves the connectives at the point where the latter separate from each other.

No nerves are borne by the first pair of connectives but the second and third each bears a pair of nerves.

Nerves of the First Thoracic Ganglion (figs. 1 and 2 Tl). The distribution of these nerves differs from that of the second and third ganglia, hence they will be described separately.

Nerve A originates from the side of the ganglion near the anterior end and runs in a lateral direction. About ·7 mm. from the origin branch *a* is given off. It runs forward for a short distance and then bifurcates, *1* running forward to innervate the ventral recti-muscles in the region of the neck, and *2* running back to a diagonal muscle. Branch *b* runs obliquely backwards and then bifurcates, each of its branches innervating ventral recti muscles. Distad of the origin of *b*, nerve A is connected with nerve *b* by means of a cross-nerve (*g*). The third branch *c* is a small one and innervates a dorsal diagonal

muscle. Branch *d* is given off shortly after the nerve enters the back. It runs back and forks at a short distance from the origin, its proximal branch goes to the dorsal recti muscles and its second branch innervates the dorsal diagonal muscles. In the dorsum of the prothoracic segment nerve *A* splits up into four branches *e*, *f*, *g* and *h*. These divide into numerous nerves which supply the muscles and integument of the back. Branches *e* and *f* innervate the anterior portions of the dorsum of the prothorax, branch *h* innervates the median portion and branch *f* the posterior portion.

Nerve B. The posterior nerve of the pro-thoracic ganglion arises from the hinder side of the lateral border of the ganglion and runs over the opening of the leg, giving off branches *a* and *b* which go to the leg. It then bends slightly forward and near the bend gives off branches *c* and *d* which run inward to muscles of the leg. Nerve B then crosses on the ventral side of nerve A into the anterior portion of the segment. Branch *e* extends forward to the neck. Distad of the origin of branch *e* the nerve divides into four branches *f*, *g*, *h* and *k*. Branch *f* runs forward for a short distance and then forks; *1* runs inward innervating the transverse muscles, and *2* travels obliquely forward innervating the muscles in the anterior portion of the segment. Branch *g* runs back and enters nerve *a*; *h* goes to a branch of the trachea and *k* travels to the ventral wall, where it divides into a number of sensory nerves.

Nerves of the Second and Third Thoracic Ganglia (figs. 1 and 2, NG2, NG3). There is but one nerve from each of these ganglia, given off from the middle of the lateral border. These are rather large nerve cords, their size being about equal to that of the connectives.

The nerve runs in a lateral direction immediately in front of the opening into the leg (*ol.*). The backward projecting nerve of the leg, (*a*), is given off about 1 mm. or less distant from the ganglion. The branching of the nerve of the leg is quite variable; occasionly the three branches *1*, *2* and *3*, are given off as separate branches of the nerve trunk NG; in other cases *1* and *2* originate as a common branch and *3* arises separately; usually, however, it was found that the nerve arose as a single branch from NG and then divided into three branches. Branch *1* runs towards the base of the leg and gives off branches *x* and *y*; *x* runs backward and innervates a large muscle lying obliquely across the inner and hinder edge of the opening into the leg; *y* supplies the muscles which lie at the inner side of the base of the leg. After giving off branch *y*, *1* continues into the leg innervating the muscles within this organ. Branch *2* travels towards the anterior side of the base of the leg where it divides into several small nerves which in-

nervate the muscles and integument at this point. Branch *3* innervates the transverse muscles which are attached near the leg, terminating in these muscles beneath the main tracheal trunk, near their lateral attachment.

After giving off the nerve of the leg, the nerve NG continues lateral and enlarges slightly to form a small ganglion, this ganglion sends off several small branches which go chiefly to the integument. One of these branches, *b*, runs forward to the anterior portion of the segment, immediately behind the conjunctiva. It sends a number of branches to the integument and these form a complicated network of nerves spreading over the ventral surface of the segment. Branch *c* bifurcates near its origin, one branch running inward to the ventral oblique muscles, and the other to the ventral integument.

In the back of the insect, the nerve bifurcates, and both branches divide profusely sending nerves to the transverse and oblique dorsal muscles.

In two of the specimens dissected a curious plexus was observed joined to the nerves of the second and third thoracic ganglia at the enlarged portion from which branches *b* and *c* arise. Loosely attached to this part of the nerve was a small ganglion-like mass (fig. 2, X.) from which two nerves ran towards the median line and two in the opposite direction, the latter more or less united. The distribution of these nerves were not thoroughly studied and needs further investigation.

Nerves of the Connectives. (Figs. 1 and 2, NC.) The nerve of the connective originates less than half a millimetre in front of the ganglion. It travels outward and about one-third of a millimetre from its origin gives off branch *a* which soon bifurcates, sending a branch (*1*) forward to anastomose with the transverse nerve of the sympathetic system; the other branch of *a* (*2*) travels back obliquely and divides into several branches which innervate the ventral recti muscles. Branch *b* is a minute nerve which is not always present. It divides into two branches which go to the ventral integument. Branch *c* originates just before the nerve reaches the tracheal trunk; it runs forward, anastomoses with the transverse nerve of the ventral sympathetic system and sends branches to the trachea and the longitudinal and transverse lateral muscles.

The nerve trunk continues across the tracheal trunk passing inside of it and, following the body wall, turns inward towards the median line of the back. Immediately after crossing the trachea the nerve gives off branch *d* which runs forward, connecting with the transverse nerve and, continuing its course, innervates the conjunctiva of the dorsum near the insertion of the recti muscles. Midway be-

tween the origin and the point where it meets the transverse nerve, branch *d* gives off a minute nerve which supplies the lateral setae.

In the dorsum the nerve branches profusely, forming a rather complicated net-work of nerves which innervates the muscles and integument of the dorsum.

The nerves of each pair of connectives and nerve A of each abdominal ganglion is connected in the dorsum with a *longitudinal nerve* (figs. 1 and 2, l.n.). This is a rather stout nerve which runs the entire length of the segment, being attached to both conjunctivas. The ends of the several longitudinal nerves are in close proximity but the nerves do not form a continuous chain. The function of this nerve has not yet been determined.

3. *THE ABDOMINAL GANGLIA AND NERVES.*

There are seven ganglia in the abdomen, situated along the median line of the venter above the ventral muscles and beneath the alimentary canal and ventral diaphragm. The ganglia, as a rule, are in the anterior third of their respective segments. The first and last ganglia, however, are usually situated on the sutural line between the segment which they respectively innervate and the one anterior to it. The lengths of the connectives are fairly uniform. Those between the sixth and seventh segments are somewhat shorter than the others owing to the moving forward of the last ganglion; for the same reason those between the third thoracic ganglion and the first abdominal are somewhat shorter than the others.

The pairs of abdominal connectives are united throughout five-sixths of their length and separate slightly near the posterior end before entering the ganglion. The fusion is usually solid, there being no indication of the duplex character of the fused portion. The last pair of connectives are sometimes united throughout their entire length, but in this case, a short crease on the dorsal side of the posterior end of the connectives marks the division between them.

Nerves of the First Abdominal Ganglion. (Figs. 1 and 2. I.) Nerve A originates from the anterior end of the lateral border of the ganglion and runs in a lateral direction. The first branch *a* is very minute and is not always present. It runs forward and unites with the transverse nerve. Branches *b* and *c* both run backward and innervate ventral recti and upper oblique muscles. Before reaching the tracheal trunk, nerve A sends a second branch to the transverse nerve. After crossing the trachea it again unites with the transverse nerve either directly or by means of a short cross nerve. In the dorsum the nerve branches profusely sending branches to the integument and muscles.

Nerve B arises from the side of the ganglion, near the posterior end. It takes a posterior lateral course, passing beneath the recti muscles. The proximal branch *a* is a minute nerve which runs forward to the suture, innervating the anterior portion of the segment. Branch *b* is given off near the origin of *a* and divides into three main branches which again divide, innervating the ventral surface of the segment. The third branch *c* arises about 1 mm. distad of the origin of *b*. It runs inward and backward and divides into three branches, one of which runs back and joins the transverse nerve of the next segment; the others innervate ventral diagonal muscles. Nerve B continues its lateral course and forks near the main tracheal trunk. The branches go to the lateral transverse muscles, traveling in close connection with the tracheal branches.

Nerves of the Second Abdominal Ganglion. (Fig. 1, II). Nerve A. This nerve is homologous with the corresponding nerve of the first abdominal ganglion but differs somewhat in the distribution of its branches. The first branch *a* is given off from the posterior side of the nerve, about ·8 mm. from the ganglion; running obliquely backward, it joins a branch of the tracheal system and follows it to the under side of the ventral recti majores. About ·8 mm. distad of the origin of *a*, branch *b* arises. This nerve has been traced to one of the branches of the tracheal system and to one of the lateral oblique muscles. In some cases *a* and *b* have been found to originate as a single branch of nerve A.

Laterad of the origin of *b*, a short branch connects nerve A with a stout unbranched nerve (fig. 1, o.n.) which is attached near the anterior conjunctiva of the ventral side of the segment and runs obliquely across the segment beneath the muscles, the other end being attached near the posterior conjunctiva of the dorsum. This peculiar nerve, which I have called the *oblique nerve*, resembles the longitudinal nerve in appearance and its dorsal attachment is not far from the posterior attachment of the latter. Both of these nerves need farther study.[1]

The fourth branch, *d*, of nerve A goes to the lower transverse muscles. The next branch is a cross-nerve between nerve A and the transverse nerve. This cross-nerve gives off a branch, *r*, which innervates the retractor spiraculi.

The farther distribution of this nerve is practically the same as that of the corresponding nerve of the preceeding segment.

Nerve B does not differ essentially from the posterior nerve of the first abdominal ganglion and therefore need not be described separately.

[1] It is possible that these nerves represent chordotonal organs.

NERVES OF THE THIRD, FOURTH, FIFTH AND SIXTH ABDOMINAL GANGLIA. (Fig. 1, III, IV, V, and VI.). Nerve A is practically identical with the corresponding nerve of the second ganglion.

Nerve B. The proximal branch *a* runs forward, and near its origin gives off two nerves, one of which enters the leg and the other goes to muscles near the opening into the leg. After giving off these nerves branch *a* forks and the two branches go to the integument near the anterior suture. From one of these nerves a minute branch runs to one of the setae, near the median line, and from the other a very small nerve runs in a lateral direction, terminating beneath the tracheal trunk. The description of nerve B of the first and second abdominal ganglia will also serve for this nerve except for the first branch just described.

NERVES OF THE LAST ABDOMINAL GANGLION. (Figs. 1 and 5, VII.). This is the largest of the abdominal ganglia and is usually situated on the line between the sixth and seventh abdominal segments, though it may be wholly within either one of these segments.

This ganglion is made up of at least two pairs of primitive ganglia, those belonging to the seventh and eighth abdominal segments. It is probable however that there are three ganglia concerned in the fusion. There is no indication of this in the ganglion itself but the fact that there are five pairs of nerves given off upholds this view. The nerves of this ganglion may be homologized with those of the other abdominal ganglia. The homology between nerve A of this and the other ganglia is readily seen from the distribution of the branches. Nerve B, too, corresponds to nerve B of the other abdominal ganglia. Nerves C and D the writer regards as belonging to what was originally the eighth ganglion. These two nerves almost invariably arise together and coalesce for some distance, and this may be regarded as an indication of their origin from the same ganglion. It is more difficult to homologize these nerves with those of the other abdominal ganglia, but the fact that the lateral nerve of the sympathetic system is in close connection with C, and that D goes exclusively to the venter are indications of the homology of these nerves with A and B respectively of the other ganglia. Nerve E may have formerly belonged to a ninth ganglion. The presence of only one pair of nerves may be due to the elimination of the second pair or to the fusion of the two pairs.

Nerve A. The anterior nerve of the terminal ganglion arises at the lateral border of the ganglion and runs back obliquely passing above the ventral recti minores and beneath the recti majores. It crosses into the back mesad of the tracheal trunk and runs above the dorsal recti muscles. The first branch *a* is given off beneath the ventral recti muscles and innervates some of these muscles. Nerve

A is connected with the transverse nerve just before and after crossing the tracheal trunk. In the back the nerve branches freely, the branches going to the dorsal muscles and to the integument as in the case of nerve A of the other abdominal ganglia.

Nerve B arises ventrad of the origin of A, travels straight back and then bends outwards so that the latter part of its course is obliquely backwards. This nerve and its branches are confined to the ventral and lateral portions of the seventh segment, and as their distribution does not differ markedly from that of nerve B of the first segment, it is unnecessary to describe it in detail here.

Nerve C originates at the lateral side of the posterior end of the ganglion and runs backward unbranched until it enters the eighth segment. Here it gives off two stout nerves *a* and *b* from its inner side, these supply the longitudinal muscles of the anal segment. The third branch *c* also goes to the anal muscles. Branches *d* and *e* innervate the dorsal wall and the nerve finally goes to the terminal spiracle.

Nerve D. This nerve almost invariably arises in connection with nerve C and the two nerves coalesce throughout part of their course. The length of the coalesced portion varies considerably with different specimens. In a few of the specimens examined nerve D arose ventrad of the origin of C and the two nerves continued free throughout their course. In one case the nerves on one side of the ganglion were free and those on the other side united.

Nerve D travels backward above the ventral recti muscles unbranched until it enters the last segment; then it passes beneath the ventral recti muscles of this segment and divides into four branches which innervate the ventral wall.

Nerve E originates from the ventral side of the posterior end of the ganglion near the median line. It runs back into the last segment. The proximal branch, (figs. 1, 5, and 7, i.n.) is the *intestinal nerve*, It travels to the side of the intestine near the junction of the rectum and colon and then bifurcates. Both branches again fork. The anterior branch (fig. 7, *a*) sends one branch forward parallel to the lateral margin of the intestine. This branch gives off several nerves which innervate the longitudinal and circular intestinal muscles. It has been traced as far forward as the anterior end of the ileum where it sends a nerve to the bladder-like expansion of the base of the Malphigian tubule. The second branch of *a* runs back innervating the rectum and the posterior portions of the Malpighian tubules. Branch *b* also divides into two nerves; one of these runs forward, sends a cross-nerve to branch *a* and then goes to the ventral portion of the colon; the other innervates the ventral side of the rectum.

At a short distance from the origin of the intestinal nerve there is a longitudinal slit in nerve E through which the vas deferens passes. The presence of this slit is rather difficult to account for as no nerves are sent to the vas at this point, nor is there any organic connection between the vas and the nerve. The formation of the slit might possibly be accounted for on the assumption that nerve E is the result of the fusion of two nerves, one of which originally passed beneath and the other above the vas. When two such nerves coalesced they would naturally remain unfused at this point in order to allow the passage of the vas deferens. This tends to confirm the assumption that the terminal ganglion is the result of the fusion of at least three ganglia. An embryological investigation would be necessary in order to settle these points.

Branch *c* is given off back of the slit and runs inwards innervating the integument near the opening of the ejaculatory duct. Branch *d* divides into several nervelets which innervate the integument near the anus. Branch *e* innervates the muscles of the proleg, *f* goes to the rectum and *g* innervates the last proleg.

The Sympathetic Nervous System.

The sympathetic nervous system of insects consists of, (1) The median unpaired system, (2) the paired lateral system, and (3) the ventral or superadded system. These systems are connected with the central system, and usually the lateral and median systems are connected. All three systems are present in the larva of *Sphida obliqua* and will be described separately in the order given above.

1. *THE UNPAIRED MEDIAN SYMPATHETIC SYSTEM.*

This is also known as the Stomatogastric or vagus system. It is connected with the central nervous system by means of the arched nerves.

THE ARCHED NERVES, (figs. 3 and 7, Ar.), arise in connection with the clypeo-labral nerves below the origin of the optic nerves. They run forward for a short distance and after separating from the clypeo-labral nerves, they curve inward and enter the frontal ganglion.

THE FRONTAL GANGLION, (figs. 3 and 7, fg.), is a small ganglion situated on the medio-dorsal line of the pharynx, in front of the supraoesophageal ganglion.

THE FRONTAL NERVE, (figs. 3 and 7, fn.), arises from the middle of the anterior border of the frontal ganglion and projects forward immediately above the pharynx. At a short distance in front of the

frontal ganglion, the nerve enters the clypeus and enlarges slightly to form a very minute ganglion (g 1) which receives branch *c* of the clypeo-labral nerve. The frontal nerve then bifurcates and the two branches run forward innervating the muscles of the anterior portion of the pharynx.

The Recurrent Nerve. (Figs. 1 and 3, r.n.) This nerve originates from the posterior end of the frontal ganglion and runs back along the medio-dorsal line of the oesophagus, passing beneath the supraoesophageal ganglion. Midway between the frontal ganglion and the brain, the recurrent nerve enlarges into a small ganglion (g3) from which a pair of small lateral nerves arise. These nerves branch near their origin, the branches innervating the dorsal portion of the pharynx. They then pass round the pharnyx and on the under side run forward innervating the ventral side of the pharynx. These nerves probably correspond with the *pharyngeal nerves* of Hammar. Those which he describes for the larva of *Corydalis cornuta*, however, originate from the frontal ganglion and not from the recurrent nerve.

The recurrent nerve continues backward, passing between the oesophagus and the aorta, adhering at first closely to the latter and afterwards to the proventriculus. Throughout its course it gives off many nerves which innervate the alimentary canal and the dorsal vessel. The recurrent nerve terminates in the vagus ganglion.

The Vagus or Stomachic Ganglion. This is situated between the proventriculus and the dorsal vessel in the posterior region of the second thoracic segment. It is very small and hardly differentiated from the recurrent nerve.

The Stomatogastric Nerves. The stomatogastric nerves arise from the posterior border of the vagus ganglion. They run obliquely to the sides of the ventriculus and then backward innervating the stomach.

2. *THE PAIRED LATERAL SYMPATHETIC SYSTEM.*

This system consists of two pairs of small lateral ganglia (fig. 3, L.G.) situated at the sides of the oesophagus, a short distance behind and to the side of the supraoesophageal ganglia. The two ganglia on either side are connected by an obsolete connective, but the pair on the right side is not connected with the pair on the left. Each pair of ganglia is joined to the brain by a pair of nerves, one of which (*p*) arises near the base of the optic nerve, and the other (*q*) from the ventral side of the brain.

Nerve p. (figs. 3 and 7). Starting from the lateral ganglion, nerve *p* runs inward and forward and unites with the supraoesophageal

ganglion at the base of the optic nerve. From this point it runs obliquely forward passing between the mandibular muscles. It bifurcates and the two branches run along the wall of the head dorsal to the ocelli, innervating the setae of the epicranium. The latter portion of this nerve has the appearance of a nerve of the brain, and is described as such by Newport, but it undoubtedly belongs to the lateral sympathetic system.

Nerve r, which arises from the lateral border of the ganglion, runs first ventrally and then bends forward. Near its base it sends three very minute branches back to a branch of the tracheal system. Near branch *a* of the maxillary nerve it enlarges into a ganglion which receives a nerve from this branch (fig. 4). It terminates in branch *d2* of the maxillary nerve near the base of the maxilla.

Nerve s arises between the origin of *p* and *q* and runs inward to the oesophagus where it branches, sending nerves to the oesophageal muscles.

Nerve t originates behind nerve *q*, travels inward and divides into three branches. The proximal branch, *x*, is given off near the lateral border of the oesophagus and goes to the oesophageal muscles. Branch *y* innervates the dorsal vessel, and *z* fuses with the recurrent nerve, thus connecting the lateral with the vagus sympathetic system.

Nerve u is given off near the base of *p* and runs in a lateral direction terminating near the origin of the labral muscles.

From the posterior side of the second ganglion two minute nerves are given off. These terminate in a gland which has the appearance of the salivary gland but which I have not succeeded in tracing thoroughly.

3. THE SUPERADDED OR VENTRAL SYMPATHETIC SYSTEM.

In the ventral sympathetic system there are, typically, a median nerve originating from each pair of connectives (except the first) in the ventral chain, and a pair of transverse nerves given off from each median nerve. The transverse nerves in each segment are closely connected with the central nervous system.

THE MEDIAN NERVES. (Figs. 1 and 2, m.n.) These nerves arise from the connectives at the point where they separate from each other. They run back between the connectives, terminating in the transverse nerves.

THE TRANSVERSE NERVES. (Figs. 1 and 2, tr. n.) In the first thoracic segment the transverse nerves do not arise from a median nerve. Instead, they originate anterior to the second thoracic gang-

lion and are connected with it by a plexus of nerve fibres which arise from its anterior end. In one specimen stained with methylen blue these fibres were highly differentiated and could be traced down the middle of the dorsal side of the ganglion, continuing as the median nerve of the next segment

From the point where the median nerve unites with the transverse nerve of the mesothorax two minute branches are given off and run to the ventral intergument.

The transverse nerves run laterally above the recti muscles near their point of insertion. Their connection with the nerves of the connectives in the thorax and with the nerves A in the abdomen have been described above and may be readily seen from the figures.

In the thorax these nerves give off several branches which go chiefly to the trachea but some minute branches have been found going to the muscles. After crossing the tracheal trunk, the nerve continues into the dorsum in close connection with a branch of the tracheal system which goes to the dorsal muscles.

In the abdominal segments near the insertion of the recti muscles the transverse nerve is very closely connected with a branch of the trachea. Not far from the ganglion it receives a nerve from branch *c* of nerve B. Before crossing the tracheal trunk, the nerve sometimes sends a branch to the transversi laterales muscles, and after crossing the trachea another branch is sent to the same muscles. In the dorsum the nerve ramifies through the dorsal diaphragm closely united with a tracheal branch. It is thus evident that the function of this nerve is to supply the respiratory system.

There are two transverse nerves given off from the last abdominal ganglion. The first one belongs to the seventh segment and is united with nerve A for a short distance, often appearing to be a branch of this nerve. Its distribution is similar to that of the other transverse nerves of the abdomen. The origin of the second pair of transverse nerves of the terminal ganglion may sometimes be traced to the dorsomedian point of the posterior end of the ganglion. There is no median nerve. The transverse nerve is fused with nerve C from the origin of the latter until it enters the eighth segment. It then separates from nerve C and projects outward. As in the case of the other abdominal transverse nerves, this one receives a branch from nerve A of the anterior segment. This nerve appears to be rudimentary. as it has been traced only a short distance from the point where it leaves nerve C.

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EXPLANATION OF PLATES.

In the figures the principal nerve trunks are labelled with capitals. Unless otherwise stated in the caption, small letters (*a*, *b*, *c*, etc.), indicate, in order, the primary branches of the nerves, and figures are used, when necessary, to indicate the secondary branches. Ex., The nerve of the second thoracic ganglion is labelled N.G2, the first branch of this nerve is marked *a* and the branches of *a* are labelled 1, 2, and 3 respectively.

Fig. 1. The caterpillar cut along the middle of the dorsum and opened, showing the entire nervous system. On the left the position of the principal muscles and of the main tracheal trunk of the left side is shown.

For nerves of head and thorax see figs. 2 and 3.
I, II, III, to VII. First to seventh abdominal ganglia.
al.c., caudal portion of the alimentary canal.
ant., antenna.
d.m., diagonal muscles.
e.d., ejaculatory duct.
l.n., longitudinal nerves of the dorsum.
o.n., oblique nerves.
r. nerve innervating the retractor spiraculi.
s. lig. suspensary ligament of the testis.
set. seta.
sp. spiracle.
s. v. seminal vesicle.
test. undeveloped gonad.
tr. left main tracheal trunk.
tr. lat. transversi laterales.
v.d. vas deferens.
v.r. maj. ventral recti majores.
v. r. min. ventral recti minores.

Fig. 2. Thoracic and first abdominal ganglia and nerves.

I. first abdominal ganglion.
A. anterior nerve of the first thoracic and the first abdominal ganglia.
B. posterior nerve of the first abdominal and first thoracic ganglia.
a, b, c, &c. first, second, third, &c. branches of the various nerves.
N.C., nerves of the connectives.
l.n. longitudinal nerve of the dorsum.
mn. median nerve.
T1, T2, T3, first, second and third thoracic ganglia.
tr. transverse nerve.
S. G., suboesophageal ganglion.

Fig. 3. Dorsal view of the head, showing the brain and its nerves and the lateral sympathetic system.

Ant. Antenna.
Ao. Aorta.
A.N. Antennal nerve.
Ar. Arched nerve.
B. B. Brain or Supraoesophageal ganglion.
C.L. Clypeo-labral nerve.
Cr. Crus cerebri.
f.g. Frontal ganglion.

f.n. Frontal nerve.
gl, g2. Small ganglia of the median sympathetic system.
Labr. Labrum.
L.G. Lateral ganglia.
oc. Ocellary nerves.
OE. Oesophagus.
O.N. Optic nerve.
p,q,r, &c., Nerves of the lateral sympathetic system.
r.n. Recurrent nerve.
set. Seta.

Fig. 4. Dorsal view of the suboesophageal ganglion and its nerves.
Cr. Crus cerebri.
con. Connective.
L. Ventral nerve.
Lab. Labium.
Lb. Labial nerve.
L.G. Lateral ganglion.
Mand. Mandible.
Maxl. Maxilla.
Md. Mandibular nerve.
Mx. Maxillary nerve.
S.G. Suboesophageal ganglion.
spin. Spinneret.

Fig. 5. Terminal ganglia and nerves of the abdomen.
VI, VII. sixth and seventh abdominal ganglia.
A, B, C, D, E. Nerves of the last ganglion.
d.r. Dorsal recti muscles.
e.d. Ejaculatory duct.
l.n. Longitudinal nerve.
o.l. Opening into last proleg.
o.m. Oblique muscles.
rect. Rectum.
r.mj. Ventral recti majores.
r.mn. Ventral recti minores.
sp. Terminal spiracle.
tr. Trachea.
tr.l. Transversus lateralis.
tr.n. Transverse nerve.
s.v. Seminal vesicle.
v.d. Vas deferens.

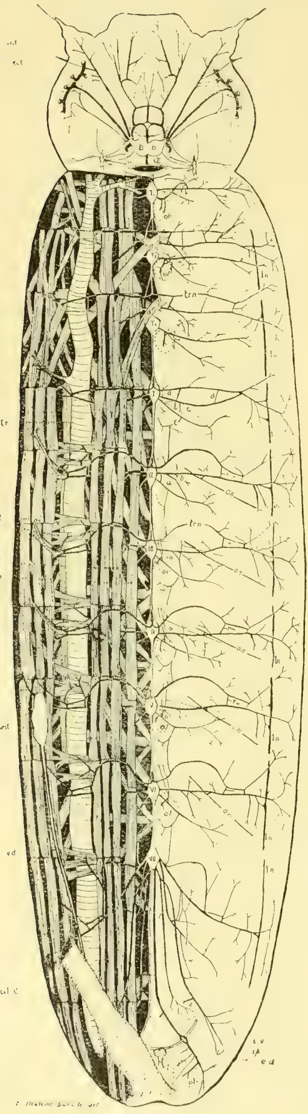
Fig. 6. Intestinal Nerve.
VII. Last abdominal ganglion.
a and b. Branches of the intestinal nerve.
E. Fifth nerve of the last ganglion.
bl. Bladder-like enlargement of Malpighian tubules.
in.n. Intestinal nerve.
int. Intestine.
m.t. Malpighian tubules.
rect. Rectum.

Fig. 7. Lateral view of the cephalic nerves.—Diagrammatic. Caption same as for figs. 3 and 4.

s.c. Accessory commissure.

Fig. 8. Oesophageal ring. The brain turned up so as to show the origin of the crura.—Diagrammatic.

Caption as in figs. 3 and 4.



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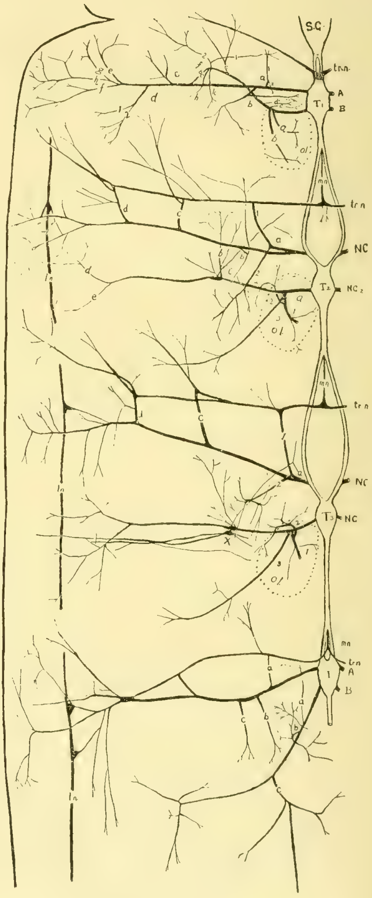

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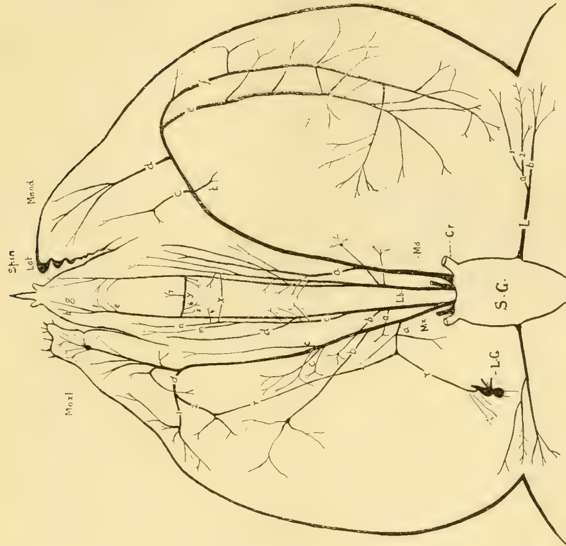
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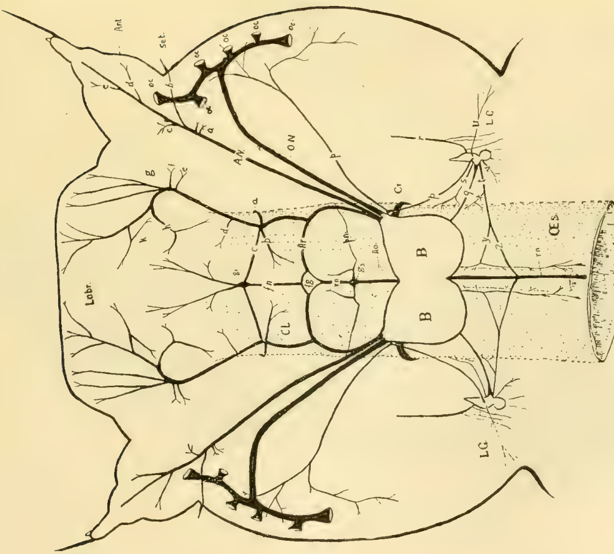
Fig. 4.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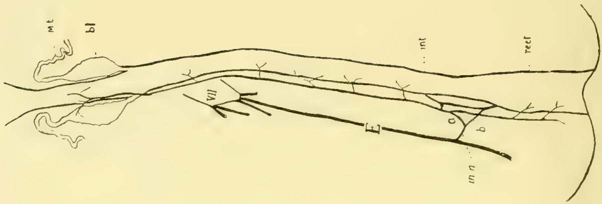

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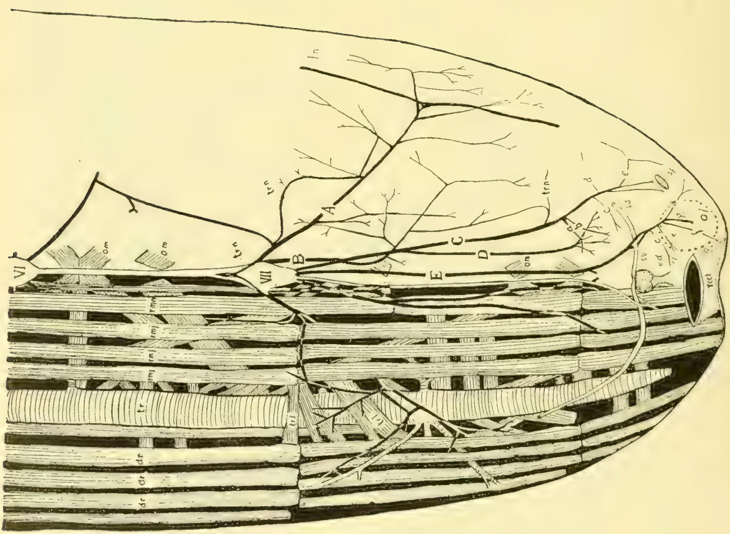

Fig. 5.

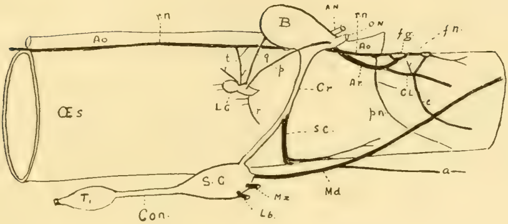
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Fig. 7..

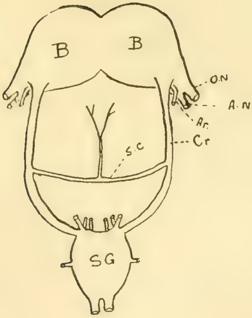
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Fig. 8.

The Effects of Music upon the Blood-Pressure.

By SWALE VINCENT, A. T. CAMERON, and H. P. ARMES.

(From the Physiological Laboratory of the University of Manitoba, Winnipeg.)

(Read May 27, 1914)

Comparatively few systematic observations have been recorded upon the physiological effects of music, notwithstanding the fact that in a general way such physiological effects are universally recognized. The sedative or soothing effect of music is well known, and this, as we shall have occasion to note more fully, is probably due to a distinct action upon the circulatory system. The opposite kind of effect, namely in the direction of inciting to increased bodily activity, is noticeable with march, dance, and military music.

So far as we are aware, the effects of music upon the blood pressure have not been investigated since the modern instruments for recording blood pressure in the human subject have been in regular use. References to the work of Dogiel, Patrizi, Mentz, Binet and Courtier, and Guibaud, are given by Jentsch (Musik und Nerven, II, Wiesbaden, 1911, p. 17), and none of these appear to have used the modern instruments. As the present communication is only of a preliminary nature no further reference to literature will be given.

Our experiments have been carried out with a Roger's Sphygmomanometer.

Simple tones (single notes, scales, arpeggi, etc.) as well as more elaborate and artistic pieces of music have been employed as stimuli. In our experiments the former have not given very concordant results, and these we do not propose to deal with at present. The latter have consisted of piano pieces, by various composers, songs with piano accompaniment, rendered by amateur and professional performers, and various compositions played by a full symphony orchestra. The individuals experimented on, male and female, have been to the number of seventeen. The age and general condition of the subjects varied within wide limits, the youngest being about 20, the oldest about 60.

The height of the normal blood pressure has also varied considerably in different individuals, the lowest being about 105 mm. mercury, the highest (arteriosclerosis) 190-210 (different days).

As regards musical impressionability, the individuals chosen for experiment may be roughly grouped in three classes, (a), distinctly musical, (b) moderately musical, and (c) non-musical. The results obtained, as might be expected, differ in these three classes, and, as also might be expected, according to the nature of the music.

In a musical person the effect of a quiet uneventful composition is a steady lowering of the blood-pressure. This result requires considerable care in interpretation, since in the majority of people, after a period of moderate activity the blood-pressure will continue to fall for some time during rest, as for example when they are comfortably seated in a chair. In all cases therefore account should be taken of the fall in the curve due to the resting condition, and unless this is exaggerated (as shown by a recovery, by taking a normal reading after cessation of the music) there can be no evidence that the music itself produced any effect on the blood-pressure. Rises are not liable to this source of error, and can only mean some change in the vascular system, due to an emotional stimulus. Here again, one must guard against emotional changes independent of the music, excitement due to the examination, and, in the concert room, due to expectancy, and disturbances from noises etc. Such rises, free from these sources of error, are the almost inevitable result of the performance of a "lively", interesting piece of music, upon a musical person. The criteria of "liveliness" are rapid movement, and intensity of tone, but other elements, entering into the constitution of what is called "dramatic music" (discords, sudden changes in tone, changes of key, etc.) also produce their effect.

In the case of pieces or passages of sustained "liveliness" the rise of blood-pressure is almost immediate, and is followed by a more or less gradual fall, but if the interest of the composition gradually rises to a climax, the height of blood-pressure will probably coincide with the occurrence of this climax, and in general the curve of blood-pressure will follow the curve of interest in the music.

The term "interesting music" has been employed so far to imply a pleasurable interest. If the music be of a novel character, so as to severely arrest the attention of a musical person, the effect upon the pressure may be a fall, and this seems to be due (see below) to the effects of altered respiration. The commonest effect of sustained attention is that the breathing is reduced to its shallowest limits for long periods, and relief is obtained by deep sighs every few minutes.

Curiously enough, so far as our experiments go, singing produces less effect than piano-playing. The effects from a full orchestra are not markedly different from those of a piece of music played upon a piano, though of course the nature of the composition will be very

different in each case. Lest this statement should be misunderstood, it will be well to explain that according to our measurements an interesting composition suitable for and played upon a piano will produce an effect upon a musical person comparable with that produced by an orchestral symphony rendered by a full orchestra. This, we take it, is an indication that the effect upon the blood-pressure is a measure of the aesthetic emotional effect, and not the effect of volume of sound as such.

With regard to moderately musical and unmusical people, the principal difficulty is to find musical compositions which to them will be of sufficient interest to produce any effect. It is clear at any rate that the vast majority of compositions which will produce emotional effects upon musical people would produce much less effect on individuals of the other two classes. We have not experimented very fully upon this point, but it seems likely that in the vast majority of such people, comparable results might be obtained by the performance of more elementary compositions, that is to say, definite march, dance, and, generally, popular music. This introduces at once the idea of association as a factor in the emotional effect. We consider this factor of importance, both with unmusical persons, and with musical persons hearing music well known to them, but it is difficult to estimate the total bearing of this factor, and we do not propose to discuss it further at this stage.

It is possible, though we have so far not investigated the point, that there is an important relationship, other things being equal, between the reaction time, and the impressionability to music.

It seems to us important that investigation upon the physiological effects of music should be to a very considerable extent confined to the effects of instrumental music, since it is obvious that the influence of words may introduce quite new factors. So far as possible, too, a distinction ought to be made between the effects of tone-stimuli and rhythmical stimuli. Speaking generally the effects of rhythm as such are more marked in proportion to other effects in the less musical groups of people.

As for the precise action of musical stimuli upon the blood-pressure, there are several possibilities:

(1) Afferent impulses may be conveyed from the organ of hearing to the nerve centres, and thence along efferent fibres to the heart, affecting its force and frequency.

(2) Afferent impulses may be conveyed from the organ of hearing to the nerve centres, and thence along efferent fibres to the vaso-motor nerves of the blood-vessels, causing vaso-constriction or dilatation in different areas, and thus affecting the blood-pressure. In this case the effects would be vaso-motor reflexes.

(3) Afferent impulses may be conveyed from the organ of hearing to the nerve centres, and efferent impulses pass down to the muscles of respiration causing alteration in depth and frequency. This is comparable with the effect upon respiration produced by stimulating the central end of the sciatic nerve. In the latter case the effect is very pronounced, the breathing is rapid and deep, and there is a marked fall in blood-pressure, due, we believe, to direct interference with the heart's action. In the case of tone-stimuli conveyed along the auditory nerve the stimulus is of course of a different character, and never produces the same kind of effect upon breathing, but effects are produced, and these undoubtedly affect the blood-pressure. It seems for example that the diminished breathing for a period, followed by a deep sigh at intervals, referred to above as characteristic of attention, will in general produce a distinct fall of pressure. The effects of different kinds of breathing upon the blood-pressure have never been fully investigated, and we hope to report more fully upon these in a later communication.

(4) Afferent stimuli arising from tones can only be conveyed along other nerves than the auditory, in the case of very deep tones. Similar reflexes to those described above might occur in this case, but such could scarcely be reckoned as musical stimuli.

Of the three causes, that affecting repiration is undoubtedly largely responsible for all falls of blood-pressure correctly traceable to musical stimuli, while that affecting rate of heart beat we consider largely responsible for rise of blood-pressure for the following reasons:

(a) It has been observed by Porter and others, and confirmed by ourselves, that electrical stimuli of equal intensity applied to the cut central end of the sciatic of the dog at different heights of blood pressure (in different animals, or produced by bleeding) result in numerically equal changes in the height of blood-pressure. This is an effect upon the blood-vessels.

(b) On the contrary, in our experiments, we have observed that, as far as we can judge, similar musical stimuli produce on persons of the same temperament, but with different blood-pressures increases or decreases of blood-pressure proportional to the height of blood-pressure. This leads to the results, which we have repeatedly obtained, that the effect in women (low blood-pressure) is numerically less than in men, while in the case of one individual, observed over a considerable range of normal pressure, the same result held generally. This result would be produced in a closed system of fixed size, by alteration of the rate of heart-beat.

In accordance with modern physiological conceptions the emotion is the result of physical changes. If this be the case, it seems reason-

able to suppose that the emotional effect of music is due to a variation in the blood supply to certain critical brain centres, depending upon the changes in the heart and blood-vessels above referred to.

We append some protocols of actual experiments.

1. Subject G (musical).

Schumann's "Papillons" No. 12. The interest of the piece rises to a climax and fades away. (Played on a piano).

Time	Blood-pressure	Remarks
5. 9½ P.M.	130 no music	normal
5.10 "	135	
5.10¼ "	138	
5.10¾ "	142	
5.11 "	140	
5.11½ "	136	
5.13¼ "	131 no music	normal

2. Symphony in D minor, Cesar Franck, III. Allegro non troppo — performed by a full orchestra.

Subject S. V. (musical).

(Normal could not be taken, as there was not sufficient interval between the two movements.)

Time	Blood-pressure	Remarks
9.07 P.M.	133	Tutti
9.07¼	142	Forte
9.08 "	145	
9.08½ "	145	Piano, melody by violins
9.09¼ "	133	
9.10 "	141	Forte
9.10¼ "	138	Tutti
9.10½ "	144	Finale, fortissimo.

3. Subject A. (musical).

Overture to Tannhäuser (Wagner) (performed by a full orchestra) (normal could not be taken, owing to the short interval taken between the different items.)

Time.		Blood-pressure.		Remarks.
4·33½ P.M.		148		
4·34	"	142		
4·34½	"	142		Quiet (Pilgrim's Chorus)
4·35	"	143		
4·35½	"	144		
4·36	"	134		Louder
4·36½	"	140		Louder still
4·37	"	141		(Heavy accompaniment.)
4·38	"	152		Quiet (Pilgrim's Chorus.)
4·38¼	"	157		Venusberg music
4·38½	"	140		do.
4·39	"	142		do.
4·39¼	"	142		
4·39½	"	135		do.
4·40	"	147		Tannhäuser's song
4·40½	"	148		do.
4·41	"	144		Venusberg music
4·41½	"	144		do.
4·42	"	140		do. agitato
4·42½	"	140		Tannhäuser's song
4·43	"	140		Venusberg music
4·43½	"	140		do. (agitato)
4·43¾	"	140		
4·44	"	143		
4·44½	"	134		Pilgrim's Chorus
4·45¼	"	139		Getting louder
4·45½	"	141		Louder
4·45¾	"	140	Finale, getting	Heavy brass
4·45⅞	"	140	louder and louder	Heavier
4·46	"	145	and more involved	Still heavier.
4·46½	"	149		
4·46¾	"	150		

Further Experiments on the Effect of Low Temperatures on the Frog.

By A. T. CAMERON.

(From the Department of Physiology and Physiological Chemistry, University of Manitoba, Winnipeg.) (Presented by Professor Swale Vincent, F.R.S.C.)

(Read May 27, 1914.)

In a previous communication Mr. Brownlee and I gave an account (Trans., 1913, Vol. 7, Sect. IV, p. 107) of some experiments on *R. pipiens*, conducted with a view to determine the condition of the frog during such cold winters as are experienced in central Canada, and the States adjacent to the south. Our conclusions were the following:

(1) Frogs freeze at a temperature of $-0\cdot44°+0\cdot02°$C. in a manner very similar to that of solutions isotonic with their body-fluid.

(2) Specimens of *R. pipiens* obtained from the neighbourhood of Chicago will survive a temperature of $-1°$C. They will not survive a temperature of $-1\cdot8°$C.

(3) The heart tissue, whether exsected or *in vivo*, of these frogs survives a temperature of $-2\cdot5°$, but is killed by a temperature of $-3\cdot0°$C.

(4) Since this is the case, and since similar experiments by other observers have shown that muscular tissue will survive a temperature of $-2\cdot9°$, while the peripheral nerves are not killed by much lower temperatures, it appears probable that the cause of death is connected with a specific temperature effect on the brain or cord.

(5) It is unlikely that frogs survive the low temperatures of the air and superficial layers of the earth of a Manitoban winter. Their winter quarters are probably situated in a layer of mud or soil which retains a temperature in the neighbourhood of 0°C.

During the past winter I have continued the experiments, with a view to determining whether there is any permanent, climatic, adaptation, or temporary, hibernatory, adaptation in the frog, which would permit greater lowering of temperature without fatal result, than that indicated in the above conclusions. My results negative this suggestion, and at the same time specify somewhat more exactly the actual death temperature of the frog *R. pipiens*. I have also made a few observations on other species, and there appear indi-

cations that slight variations can occur in different species, to the extent of a few tenths of a degree only.

The method employed in the experiments was that previously described (loc. cit., p.120). The results are given below. The first four are those previously obtained by Mr. Brownlee and myself by this method. The temperatures given are for the stomach, and were registered by an iron-constantan thermo-needle attached to a D'Arsonval galvanometer.

No. of Expt..	*Date*	*Species*	*Source*	*Limits of Temperature*	*Duration between these limits.*	*Result*
1.	8·IV·13	*R. pipiens*	Illinois	−0·5°C.	8 hrs.	Recovered in 1·3 hours
2.	28·III·13	"	"	−0·8° to −1·0°	0·5 "	Recovered in 1·5 hours
3.	23·IV·13	"	"	−1·5° " −1·7°	2 "	Did not recover. Tissue alive.
4.	3·IV·13	"	"	−2·0° " −2·5°	2 "	Did not recover. Tissues alive.
5.	26·X·13	"	"	−1·00° " −1·06°	0·7 "	Recovered in 2·5 hours.
6.	25·X·13	"	"	−1·10° " −1·4°	1 "	Did not recover. Tissues alive.
7.	26·X·13	"	"	−1·25° " −1·4°	1·3 "	Did not recover. Tissues alive.
8.	25·X·13	"	"	−1·8° " −1·9°	1 "	Did not recover. Tissues alive.
9.	14·II·13	"	"	−1·2° " −1·45°	0·5 "	Did not recover. Tissues alive.
10.	15·XI·13	"	Minnesota	−0·7° " −0·8°	2 "	Recovered in 2·5 hours
11.	8·XI·13	"	"	−1·2° " −1·4°	2 "	Did not recover. Tissues alive.
12.	8·XI·13	"	"	−1·5° " −1·8°	2 "	Did not recover. Tissues alive.
13.	31·I·14	"	Manitoba	−0·5° " −0·7°	1 "	Recovered in 1·5 hours.
14.	14·II·14	"	"	−0·9° " −1·1°	1 "	Recovered in 20 hours (see below)
15.	18·I·14	"	"	−0·9° " −1·35°	1 "	Did not recover. Tissues alive.
16.	18·I·14	"	"	−1·2° " −1·9°	1 "	Did not recover. Tissues alive.
17.	16·XI·13	*R. clamitans*	Minnesota	−0·55° " −0·65°	2·5 "	Recovered in 2 hours.
18.	16·XI·13	"	"	−0·7° " −0·9°	2 "	Did not recover. Tissues alive.
19.	9·XI·13	"	"	−1·12° " −1·31°	2 "	Did not recover. Tissues dead.
20.	9·XI·13	"	"	−1·27° " −1·41°	2 "	Did not recover. Tissues dead.
21.	23·IV·14	*R. sphenocephala*	N. Carolina	−0·5°	1 "	Recovered in less than 2 hours.
22.	23·IV·14	"	"	−0·52° " −0·68°	1 "	Did not recover. Tissues alive.
23.	22·IV·14	"	"	−0·82° " −0·92°	1 "	Did not recover. Tissues alive.

It will be observed that the temperature limits are much greater for the Manitoban frogs than for the others. This was due to the fact that the frogs used were much smaller, and consequently the temperature control was not so effective.

In the experiments there was as a rule no marked gradation of body-temperature. Simultaneous observations of the skin or mouth temperature were made in every case, and gave values differing only a few tenths of a degree from those recorded for the stomach.

Considering the results for *R. pipiens*, it is evident that no differences greater than the limit of experimental error were obtained for specimens from Manitoba, Minnesota, and Illinois. Considering

the lowest temperature reached as the determining factor, one may conclude that exposure to $-1 \cdot 4°C$. for one hour is fatal (experiments 6, 7, 9, 11, 15), while exposure to $-1 \cdot 1°C$. for a similar period is not fatal (experiments 2, 5, 14). The death temperature for this species can therefore be taken as $-1 \cdot 25° \pm 0 \cdot 15°C$. Prolonged exposure at slightly higher temperatures may prove fatal. I have been unable to test this point specifically. One may perhaps infer from the uniformity of the results obtained that this is not the case. There appears to be no variation with time of year, since these measurements were made at periods corresponding to the onset of winter (October-November), depth of winter (January-February), and spring (March-April, for Illinois frogs). Age also appears to have no effect since similar results were obtained with full-grown Illinois and Minnesota frogs, weighing 30 grams or more, and half-grown Manitoban frogs, weighing from 10 to 15 grams.

An objection which might possibly be put forward to these results is that the actual cause of death is not the minimum temperature to which the animals are subjected, but either the initial rate of cooling or the subsequent rate of warming to room temperature. In experiments carried out under usual conditions I have always found that recovery, when it takes place, takes place within between one and three hours after the thaw is complete. It takes a little longer, the lower the temperature attained, but the "recovery-point" is fairly sharp. I have carried out two experiments which show the effect of rapid heating. I subjected two Minnesota frogs (*R. pipiens*) to a temperature of from $-0 \cdot 7°$ to $0 \cdot 8°C$ for two hours. One, allowed to warm up gradually, recovered perfectly in two and one-half hours. The other was taken directly from the cooling apparatus at its minimal temperature, and placed in warm water at a temperature of $+27°C$., and so heated in 8 minutes to a temperature of $+15°C$. It was then removed and placed in water at room temperature. It recovered in part, but very slowly. After 24 hours all its reflexes were present except that of lung-breathing. It was peculiarly hypersensitive Tapping it gently threw it into convulsions. It remained in this pathological condition for five days, when it died, without having resumed lung-breathing at any period. A second less extreme experiment was carried out accidentally. The small frog employed in experiment 14 was allowed to warm up too rapidly in a warm room. It developed the same hypersensitive condition, but to a less degree, and did not breathe for more than seven hours, although it had completely recovered in 20 hours.

These experiments show conclusively that rapid heating produces an entirely different set of phenomena to those observed in the normal

experiments, so that it may be concluded that the much slower rate of heating which takes place in the latter does *not* affect the result, and since the rate of cooling is similarly slow, that this also is not a controlling factor.

The cause of death in the experiments appears to be due to a specific temperature effect on the higher coordinative centres of the brain and cord. In our previous communication Mr. Brownlee and I gave evidence to show that the various tissues are not killed until a much lower temperature is attained, and it will be observed that in all the experiments with *R. pipiens* quoted above the separate tissues (heart, striped muscle, peripheral nerve) were not killed.* In experiments 12 and 16 I have compared the gross reflexes obtained by stimulating parts of the brain of the dead frog with those obtained in the living frog under chloroform, and could observe no differences. Apparently only the coordinating centres are affected. It may be assumed perhaps that that controlling lung-respiration is an essential factor in the cause of death.

The few experiments carried out on *R. clamitans* and *R. sphenocephala* appear to indicate that, while the general result holds, the actual death temperature is a few tenths of a degree higher. More accurate methods would be required to establish exactly the extent of this variation. The range of these frogs is distinctly further to the south than that of *R. pipiens*, and the difference may indicate a slight degree of adaptation in the different species.

All the observations on which reliance can be placed, on the winter habits of *R. pipiens*, confirm the experimental results of this paper. Mr. Reed, Laboratory Steward of the Department of Physiology of the University of Minnesota, from whom the Minnesota frogs were obtained, informed me that during the winter the Indians in different parts of Minnesota who supply him with frogs obtain these in large numbers by digging down to unfrozen springs. He himself, searching for frogs in spring, has frequently found creeks (in which in a previously severe winter the water had completely frozen) containing large numbers of dead frogs.

The Manitoban material was obtained for me by one of our students, Mr. E. Rutherford, to whom my thanks are due. He obtained the frogs from springs, in the neighbourhood west of Brandon, in the western part of the Province. These springs remain unfrozen and open at the surface throughout the winter, although the external temperature usually reaches $-40°$C. at least once, and may remain below $-30°$ for long periods. The frogs were obtained at the end of

[1]We have discussed the cause of death of these tissues in the paper referred to (Trans. 1913, Sect. iv., p.114).

December after some severe weather had already been experienced. By poking a stick a few feet down the narrow opening of a spring, and stirring the surrounding mud, they were at once caused to rise to the surface, and could be secured. Placed on the surface of the ground, at a little distance from the spring, they immediately endeavoured to return to it.

Several observations have been made in the laboratory in line with those just quoted. During the night of November 9th last, a rather cold night, the window of our frog room was accidentally left open. A flat tank contained Minnesota frogs. These were partially frozen, but not killed, showing that a degree of cold below zero had been reached for a short time. A second tank contained Illinois frogs. This tank consisted of a sloping board, below which was a small runnel filled with water. In the morning the surface of the water in the runnel was frozen over, and beneath it was an almost solid mass of frogs, all living. This observation led to the following experiments.

A pail was half filled with water, with a little mud at the bottom; boards were fixed across the pail above the water surface, and half a dozen frogs placed on these. The pail was placed on the roof of the University building during the whole of one night, in which the minimum temperature reached was $-5 \cdot 5°C$. By morning, about an inch of ice had formed on the surface of the water, and over the interior surface of the pail. On breaking the surface of the ice two frogs immediately rose to the surface of the water. On pouring away the water, the remaining frogs were found in a more or less somnolent condition, but perfectly normal, resting on the surface of the mud. Similar experiments in which the water was replaced by thin muds invariably gave fatal results. The frogs made no effort to burrow or dive beneath the mud, even when it was only of the consistency of a thin cream.

The data given above led me to the following conclusions:

(1) The death-temperature of *R. pipiens* from cold is $-1 \cdot 25° \pm 0 \cdot 15°C$.

(2) There is no climatic adaptation, nor any periodic adaptation due to hibernation, in *R. pipiens*.

(3) The cause of death is a specific temperature effect on the co-ordinating centres on the central nervous system. Those controlling lung-respiration may be specially concerned.

(4) Frogs surviving degrees of cold such as those occurring during a Manitoban winter do so below the surface, near the margins of

springs, and are themselves subjected to temperatures below the freezing-point of water.

(5) There seems to be a slight variation in the death-temperature from cold of different species of frogs, amounting to some tenths of a degree Centigrade.

(6) Frogs heated rapidly to normal room temperature from a temperature just below the freezing-point of their body fluids (and not itself capable of causing death) are thrown into a peculiar hyper-sensitive condition, in which cessation of lung-breathing takes place for long periods.

I desire to thank Professor Swale Vincent for his continued interest in this work. My thanks are also due to Miss Dickerson and Dr. Hussakof of the American Museum of Natural History for assistance in obtaining the southern species of frogs which I have employed.

This work has been carried out in connection with a committee of the British Association for the Advancement of Science, appointed to consider "The Effect of Low Temperatures on Cold-blooded Animals."

The expenses of the research have been in large part defrayed by a grant to Professor Vincent from the Government Grant Committee of the Royal Society of London.

Some Observations on Vaso-motor Reflexes.

By SWALE VINCENT and A. T. CAMERON.

(From the Physiological Laboratory, University of Manitoba, Winnipeg.)

(Read May 27, 1914.)

The present investigation was suggested by the conflicting results obtained by our senior class of students in trying to obtain the results described in the majority of text-books on stimulation of the central end of an afferent nerve, and by what seemed to us an inexplicable contradiction frequently met with, between the effect of stimulating the cut central end of a sensory nerve, and the effect of stimulating the terminals of such a nerve, as for example, in the skin.

Insufficient attention has been paid by previous investigators to the specific pharmacodynamic effect of the anaesthetic employed. It seems to have been assumed by most workers that a standard condition of the animal should be aimed at, in which disturbing influences due to reflex muscular spasms and reflex respiratory movements were as far as possible eliminated. Such an object is undoubtedly desirable from many standpoints, but has in our opinion the supreme disadvantage that the specific action of the anaesthetics concerned is disregarded. In experiments with dogs the majority of observers seem to have employed ether as an initial anaesthetic followed by morphia, and frequently curare. We have found no detailed account of what happens in the record of the vaso-motor reflexes if the animal be simply anaesthetised with ether. We have considered that this problem should not be shirked, especially as such a condition is one very frequently met with in surgical procedure upon the human subject.

The problem of the vaso-motor reflexes is of course intimately connected with that of shock, but with the latter subject itself we do not propose to deal.

From a large number of experiments on dogs, cats, and rabbits we are led to the following conclusions:

When an animal is deeply under the influence of ether, it is frequently impossible to obtain any vaso-motor reflexes whatever. When anaesthesia is fairly complete the effect of stimulating the central end of the cut sciatic nerve is sometimes a distinct rise. As the effect of the anaesthetic begins to pass off, the rise is followed by a more or less

pronounced fall. Respiratory movements are markedly increased, and the extent of the fall appears to be largely proportional to the violence of the respiratory activity. During the actual stimulation there is either a very slight rise, or a more marked rise, or the pressure remains about constant, while the fall usually begins at the moment of cessation of the stimulation. There is thus a clear indication of the action of two opposing influences, a reflex vaso-constriction, producing a rise, and violent respiration, producing a fall.

A similar fall of pressure is brought about by performing rapid artificial respiration by compression on the thorax, and can be induced in the human subject by rapid and deep voluntary respiration.

The effects so far described (except the last) apply to animals anaesthetised with ether, and the same are generally true if chloroform, chloral hydrate, or urethane are employed. When the animal is under the influence of morphia, electrical stimulation of the central end of the sciatic produces a rise of pressure, while mechanical stimulation of the skin produces a fall, but there is every reason to believe that this is after all a quantitative, and not a qualitative difference. It is difficult to apply a mechanical stimulation to the skin which can be considered as the equivalent of a rapidly interrupted electrical stimulation upon the sciatic.

When the animal is fully under the influence of curare, stimulating the central end of a cut nerve trunk invariably causes a rise of blood pressure. This effect seems to be due, largely at any rate, to the cessation of respiratory movements.

The more widely the thorax is opened, the more does the fall of blood pressure obtained by stimulation of nerve tend to become replaced by a rise (animal under ether). The lowering of blood pressure when the central end of the sciatic nerve has been stimulated, as also when rapid artificial respiration has been performed by compression of the thorax, and further also when rapid and deep voluntary respiration is performed upon human beings, is probably due to direct mechanical influence upon the heart's action, or interference with the return of blood to the heart, or both.

The result of a weak stimulation is usually a fall of blood pressure, while a pressor effect follows as a rule a stronger stimulus (confirmatory of Knoll and of Hunt). The difference however we have not observed when the thorax is opened.

Cooling the nerve tends to produce vaso-dilator effects (confirmatory of Howell, Budgett and Leonard, and of Reid Hunt). This also we have been unable to observe in an animal with the thorax opened.

Stimulation of the skin, kneading of muscle, and manipulation

of the intestines, all cause a fall of blood pressure, under certain conditions, and a rise under other conditions. These conditions we believe are the same as for the corresponding results with the sciatic nerve, though it is not always so easy to demonstrate this.

The vaso-motor reflex from the intestine is abolished by full doses of nicotine, is reduced by section of the great splanchnic nerve on both sides, and is abolished by extirpation of the semilunar ganglion.

Our evidence in favour of the existence of vaso-dilator fibres in afferent nerve trunks consists of results from certain animals in which, no matter what the condition, with thorax opened, and curare administered, stimulation of such nerve trunks resulted in a fall of blood pressure, and secondly from the observations made during experiments on the kneading of muscle, in which marked double-fall effects were produced, easily traceable to separate causes: a vaso-dilatation and a respiratory effect.

Whether a rise or fall of blood pressure will result from stimulation of an afferent nerve (terminals or cut central end) depends on the relative effects of the three primary causal factors (a) reflex vaso-dilation; (b) reflex vaso-constriction, and (c) frequency and depth of respiration, and the relative predominance of one or more of these factors is determined by (i) the strength of stimulus, (ii), the temperature of the nerve, (iii) the anaesthetic, (iv) the degree of anaesthesia, and (v) the idiosyncrasy of the animal.

We beg to acknowledge the valuable assistance of Mr. John Carmichael in all the experiments.

Part of the expenses of this investigation has been defrayed by a grant made by the British Association for the Advancement of Science to the Ductless Glands Committee of the Association.

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(*Exclusive of Entomology*)

By E. M. WALKER, B.A., M.B., Toronto.

Presented by LAWRENCE M. LAMBE, F.R.S.C.

INVERTEBRATA.

CŒLENTERATA.

BIGELOW, HENRY B.

Medusae and Siphonophora collected by the United States Fisheries steamer "Albatross" in the Northwestern Pacific, 1906.

Proceedings of the United States National Museum, March, 1913, Vol. 44, No. 1946, pp. 1-119, with plates 1-6.

A number of species are reported from off the coast of British Columbia. *Pandea rubra*, n. sp. (Pl. 2, figs. 1-7) was taken off the coast of the Queen Charlotte Islands.

FRASER, C. MCLEAN.

Hydroids from Vancouver Island.

Bulletin No. 1, Victoria Memorial Museum, Geological Survey of Canada, 1913, pp. 147-155.

Sixty-three species are listed, with notes on their habitats and local distribution.

Hydroids from Nova Scotia.

Bulletin No. 1, Victoria Memorial Museum, Geological Survey of Canada, 1913, pp. 157-180, with plates xi-xiii.

Fifty species are listed and two new species described, viz. *Campanularia magnifica* and *Cryptolaria triserialis*.

MCMURRICH, J. PLAYFAIR.

On two new Actinians from the coast of British Columbia.

Proceedings of the Zoological Society of London, 1913, pp. 963-972, pl. xcviii.

Describes *Peachia quinquecapitata*, n. sp. and *Bicidium aequoreae*, n. sp., and gives a key to the known species of Peachia.

Description of a new species of Actinian of the genus Edwardsiella from Southern California.

Proceedings of the United States National Museum, April, 1913, vol. 44, No. 1967, pp. 551-553, with one text figure. (*Edwardsiella californica*, n. sp.)

Annelida.

Gerould, John Hiram.

The Sipunculids of the eastern coast of North America.

Proceedings of the United States National Museum, April, 1913, vol. 44, No. 1959, pp. 373-437, with plates 58-62.

Five species and varieties are reported from Canadian waters, viz. *Phascolosoma margaritaceum* (Sars), *Phascolion strombi* (Montagu) and varieties *fusça*, n. var., and *canadensis* n. var.; and *P. alberti* Slinter.

McIntosh, William C.

Notes from the Gatty Marine Laboratory, St. Andrews, No. xxxv, 3.

On Myriochele heeri etc. dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves.

Annals and Magazine of Natural History, 1913, 8th series, vol. xii, No. 68, pp. 166-169.

Potts, F. A.

Stolon formation in certain species of Trypanosyllis.

Quarterly Journal of Microscopical Science, 1913, vol. 58, pt. 3, No. 231, pp. 411-446, with 8 text figures.

The swarming of Odontosyllis.

Proceedings of the Cambridge Philosophical Society, 1913, vol. 17, pt. 2, pp. 193-200.

Arthropoda.

Prince, Edward E.

A new Canadian Cirripede, parasitic on a Shrimp.

The Ottawa Naturalist, January, 1913, vol. xxvi, No. 10, pp. 121-125, with text figures 1-5.

An account of a remarkable new Rhizocephalan parasite of Crangon, from Vancouver Island, described by F. A. Potts as *Mycetomorpha vancouverensis*.

Stewart, Dorothy A.

A report on the extra-Antarctic Amphipoda Hyperiida collected by the "Discovery."

Annals and Magazine of Natural History, 1913, 8th series, vol. xii, No. 69, pp. 245-265.

In this paper *Hyperia galba* (Montagu) is reported from the Banks of Newfoundland.

Robertson, A. D.

Mollusca (of the Toronto Region).

The Natural History of the Toronto Region, chap. xxi, pp. 288-294. The Canadian Institute, Toronto, 1913.

Stafford, Joseph.

The Canadian Oyster—its development, environment and culture.

Commission of Conservation, Canada, 1913, 159 pp. with 4 plates and 1 map.

STERKI, V.

Sphaeriidae, old and new, III.

The Nautilus, February, 1913, vol. xxvi, No. 10, pp. 117-119.

Contains a description of a new species, *Pisidium columbianum* from various parts of British Columbia.

THOMPSON, W. F.

Report on the clam beds of British Columbia.

Report of the Commission of Fisheries for the year ending Dec. 31, 1912, Province of British Columbia, pp. 37-56, with 14 plates.

WALKER, BRYANT.

The Unione Fauna of the Great Lakes.

The Nautilus, June, 1913, vol. xxvii, No. 2, pp. 18-23, with one text figure.

Idem, July, 1913, vol. xxvii, No. 3, pp. 29-34, with two text figures.

Idem, August, 1913, vol. xxvii, No. 4, pp. 41-47, with two text figures.

Idem, September, 1913, Vol. xxvii, No. 5, pp. 56-59.

A careful study of the origin and distribution of the Unionidae of this region.

TUNICATA.

HUNTSMAN, A. G.

Protostigmata in Ascidians.

Proceedings of the Royal Society, 1915, B, vol. 86, pp. 440-453, with two text figures.

On the origin of the Ascidian Mouth.

Proceedings of the Royal Society, 1915, B, vol. 86, pp. 454-459, with two text figures.

The classification of the Styelidae.

Zoologischer Anzeiger, April, 1913, Bd. xli, Nr. 11, pp. 482-501, with 13 text figures.

RITTER, WILLIAM E.

The Simple Ascidians from the Northeastern Pacific in the collection of the United States National Museum.

Proceedings of the United States National Museum, June 1913, vol. 45, No. 1989, pp. 427-505, with plates 33-36.

Includes records of species from British Columbia waters.

MOLLUSCA.

DALL, WILLIAM HEALEY.

Diagnoses of new shells from the Pacific Ocean.

Proceedings of the United States National Museum, June, 1915, vol. 45, No. 2002, pp. 587-597.

Includes *Tritonofusus jordani*, n. sp., from the Gulf of Georgia.

DALL, WILLIAM HEALEY and BARTSCH, P.

New species of Mollusks from the Atlantic and Pacific Coasts of Canada.

Bulletin No. 1, Victoria Memorial Museum, Geological Survey of Canada, 1913, pp. 139-145, with plate x.

Contains descriptions of six species of Gasteropods of which five are new, viz.: *Turbonilla* (*Pyrgissus*) *hecuba* (Barrington Passage, N.S.); *Odostomia* (*Evalea*) *cassandra*, *O.* (*Evalea*) *cyprea*, *O.* (*Evalea*) *hypatia* and *O.* (*Evalea*) *skidegatensis*, all from Skidegate.

HANHAM, A. W.

Note on a few British Columbia Marine shells.

The Nautilus, April, 1913, vol. xxvi, No. 12, pp. 133-136.

KEMP, ERNEST.

Report on oyster culture by the Department's expert for the Season of 1912.

Forty-sixth Annual Report, Department of Marine and Fisheries, 1912-13 (1913). Fisheries, Appendix No. 16, pp. 344-350.

Gives information on oyster culture in the Maritime Provinces.

L. (LATCHFORD, HON. F. R.)

Preliminary List of Ottawa Sphaeriddae.

The Ottawa Naturalist, April, 1913, vol. xxvii, No. 1, pp. 19-20.

Records 42 species of bivalves of this family from the vicinity of Ottawa.

PATTON, M. J.

Oyster farming in Prince Edward Island.

Commission of Conservation, Canada, 1913, Rep. 4th Annual Meeting, pp. 75-86.

VERTEBRATA.

PISCES (Fishes).

BLAKE, W. H.

The wing-footed or shining one.

The University Magazine, 1913, vol. xii, No. 2, pp. 288-298.

A charming article, containing a description of the Malbaie Trout (*Salvelinus nitidus* or *alipes*) and its haunts in Northern Quebec.

CAMERON, A. T.

Note on the Iodine content of fish-thyroids.

The Bio-chemical Journal, 1913, vol. vii, No. 5, pp. 466-470.

GILBERT, C. H.

Age at maturity of the Pacific Coast Salmon of the genus Oncorhynchus.

Report of the Commissioner of Fisheries for the year ending December 31, 1912, Province of British Columbia, pp. 57-70, with 19 plates (1913).

(Republished by permission of the Bureau of Fisheries, Washington, D.C.).

Descriptions of two new fishes of the genus Triglops from the Atlantic coast of North America.

Proceedings of the United States National Museum, April, 1913, vol. 44, No. 1963, pp. 465-468, with plate 64.
Includes *Triglops ommatistius terraenovae*, n. subsp., from station 2445 of the "Albatross," off the coast of Newfoundland.

HALKETT, ANDREW.
Check list of the fishes of the Dominion of Canada and Newfoundland.
Ottawa, 1913, 138 pp. with 14 plates. (Issued from the Department of Marine and Fisheries.)
Notes on the distribution of each species are given and the majority are illustrated by reproductions from photographs.

MCMURRICH, J. PLAYFAIR.
The life cycles of the Pacific Coast Salmon belonging to the genus Oncorhynchus, as revealed by their scale and otolith markings.
Transactions of the Royal Society of Canada, series 3, 1912 (1913), vol. vi, section iv, pp. 9-28, with plates i-x.
Notes on the scale-markings of the Halibut and their bearing on questions connected with the conservation of the Fishery.
Transactions of the Royal Society of Canada, series 3, 1913, vol. vii, section iv, pp. 1-8 (paging of separate) with 3 plates. (Separata published in 1913).
Some further observations in the life histories of the Pacific Coast Salmon as revealed by their scale and otolith markings.
Transactions of the Royal Society of Canada. Series 3, 1913, vol. vii, section iv, pp. 1-9 (paging of separate) with 10 plates. (Separata published in 1913).
Salmon fisheries of British Columbia.
Commission of Conservation, Canada, 1913, Report of the 4th Annual Meeting, pp. 48-59.

NASH, C. W.
Fishes (of the Toronto Region).
The Natural History of the Toronto Region, chap. xix, pp. 249-271. The Canadian Institute, Toronto, 1913.

PRINCE, EDWARD E.
The Pearlsides. A luminous fish new to Canada.
Rod and Gun in Canada, April 1913, vol. 14, No. 11, pp. 1143-1145, with 1 figure.
A popular account of a remarkable luminous fish, *Maurolius pennanti* Walbaum.

RODD, J. A.
Fish Breeding.
Forty-sixth Annual Report, Department of Marine and Fisheries, 1912-13 (1913). Fisheries, Appendix No. 18, pp. 356-398.
Gives information on the operations of the 51 hatcheries distributed throughout the Dominion and a statement of the distribution of fry from the hatcheries during the season of 1913.

TANNER, THOMAS.

Report on fish and fisheries of Hudson Strait based on observations made during an official patrol, October, 1912, to September 1913, by Thomas Tanner, Dominion Customs and Fishing officer.

Forty-sixth Annual Report, Department of Marine and Fisheries, 1912-1913 (1913). Fisheries, Appendix No. 19, pp. 399-400.

Information is given on the kinds of food-fish and possibilities of development of the fisheries of this region.

AMPHIBIA (Batrachians).

COUPIN, HENRI.

Le chant des grenouilles.

Le Naturaliste Canadien, November, 1913, vol. xl (xx of the new series), No. 1, pp. 69-74.

Describes the sounds produced by various species of frogs and toads.

PIERSOL, W. H.

Amphibia (of the Toronto Region).

The Natural History of the Toronto Region, chap. xviii, pp. 242-248. The Canadian Institute, Toronto, 1913.

THOMPSON, FLORENCE D.

On some organs in the cervical region of the frog.

Transactions of the Royal Society of Canada, 3rd series, 1912 (1913), vol. vi, section iv, pp. 61-71, with plates 1-6.

REPTILIA.

WILLIAMS, J. B.

Reptiles (of the Toronto Region).

The Natural History of the Toronto Region, chap. xvii, pp. 238-241. The Canadian Institute, Toronto, 1913.

AVES. (Birds)

AUBOUER, L.

L'appetit des Oiseaux.

Le Naturaliste Canadien, May, 1913, vol. xxxix, No. 11, pp. 161-164.

BEAUPRÉ, EDWARD.

Bird Notes.

The Ottawa Naturalist, June-July, 1913, vol. xxvii, Nos. 3 and 4, p. 56.

Records the occurrence of a flock of Canada Jays near Kaladar station, Lennox Co., Ontario, an unusually southern locality.

BENT, A. C.

Notes from Labrador.

Bird-Lore, January-February, 1913, vol. xv, No. 1, pp. 11-15, with two photographic illustrations.

Gives notes on 19 species of birds from the north-east coast of Labrador.

BIRD-LORE (Editorial).
Bird-Lore's Thirteenth Bird Census.
January-February, 1913, vol. xv, No. 1, pp. 20-45.
Records of birds observed about Christmas time at many localities, including Guelph, London, Millbrook and Reaboro, Ontario.

CALVERT, E. W.
Guelph Winter Birds in 1912-13.
The Ontario Natural Science Bulletin, No. 8, 1913, pp. 51-52.

Migration report of the Wellington Field Naturalists' Club. Station, Guelph, Ontario. Season of 1912.
The Ontario Natural Science Bulletin, No. 8, 1913, pp. 53-55.
Gives dates of first and last appearance of birds, notes on abundance or scarcity, and whether they breed in this locality or not.

CHAPMAN, FRANK M.
Notes on the plumage of North American Sparrows. Nineteenth Paper.
Bird-Lore, January-February, 1913, vol. xv, No. 1, pp. 18-19, with coloured frontispiece and one text figure.
Describes the plumage of the Snow Bunting and McKay's Snow Bunting.
Notes on the plumage of North American Sparrows. Twentieth Paper.
Idem, March-April, 1913, vol. xv, No. 2, pp. 108-109, with coloured frontispiece.
Describes the plumage of the Fox Sparrow.

Notes on the plumage of North American Sparrows. Twenty-third Paper.
Idem, September-October, 1913, vol. xv, No. 5, p. 304, with coloured frontispiece.
Describes the plumage of Harris's Sparrow and the Golden-crowned Sparrow.

Notes on the plumage of North American Sparrows. Twenty-fourth Paper.
Idem, November-December, 1913, vol. xv, No. 6, pp. 366-367, with coloured frontispiece.
Describes the plumage of the Aleutian Rosy Finch.
(See also Miller, W. de W.)

CHILTON, ROBERT B.
Evening Grosbeak in Ontario.
Bird-Lore, September-October, 1913, vol. xv, No. 5, pp. 309-310.
Reports seeing a flock of this bird at Cobourg, Ontario.

CLEAVES, HOWARD H.
What the American Bird Banding Association has accomplished during 1912.
The Auk, April 1913, vol. xxx, No. 2, pp. 248-261.
Contains references to results obtained in Ontario and Nova Scotia.

CLEGHORN, ALLEN.
The winter birds of Algonquin Park.
The Wilson Bulletin, September 1913, vol. xxv, No. 3, pp. 145-147.

Cooke, Wells W.

The migration of North American Sparrows. Twentieth Paper.
Bird-Lore, January-February, 1913, vol. xv, No. 1, pp. 16-17.
Gives dates and localities in connection with the migration of the Snow Bunting.

The migration of North American Sparrows. Twenty-first Paper.
Idem, March-April, 1913, vol. xv, No. 2, pp. 104-107, with map of North America, showing isochronal lines of the Fox Sparrow.
Gives details of the Fox Sparrow.

The migration of North American Sparrows. Twenty-second Paper.
Idem, May-June, 1913, vol. xv, No. 3, p. 171.
The Pyrrhuloxia and the Cardinal.

The migration of North American Sparrows. Twenty-third Paper.
Idem, July-August, 1913, vol. xv, No. 4, pp. 236-240.
The Black-throated Sparrow, Bell's Sparrow, the Sage Sparrow and Lincoln's Sparrow.

The migration of North American Sparrows. Twenty-fourth Paper.
Idem, September-October, 1913, vol. xv, No. 5, pp. 301-303.
Harris's Sparrow and the Golden-crowned Sparrow.

The migration of North American Sparrows. Twenty-fifth Paper.
Idem, November-December, 1913, vol. xv, No. 6, pp. 364-365.
The Aleutian Rosy Finch.

Distribution and migration of North American Herons and their allies.
Biological Survey, Bulletin No. 45, May, 1913, United States Department of Agriculture, pp. 1-70, with 21 maps.
The maps illustrate the distribution (places of breeding and occurrence during the summer) of these birds.

Saving the ducks and geese.
The National Geographic Magazine, March, 1913, vol. xxiv, No. 3, pp. 361-380, with 8 half-tone illustrations and 7 maps.
The maps illustrate the distribution, migration routes and breeding places of North American Ducks and Geese.

Criddle, Norman.

New or rare bird records from Manitoba, 1912.
The Ottawa Naturalist, January, 1913, vol. xxvi, No. 10. pp. 126-127.
Records the occurrence of Say's Phoebe and Oberholster's Horned Lark in Manitoba and gives notes on the distribution of several other birds.

Dear, L. S.

Records.
The Oologist, October, 1913, vol. xxx, No. 10, p. 263.
Gives notes on the Mourning Dove and Great Blue Heron at Fort William, Ontario.

Dionné, C. E.

Ornithologie de Belle-Isle.
Le Naturaliste Canadien, July, 1913, vol. xl, (xx of the new series) No. 1, pp. 4-8.
A general description of the island is given with a few faunistic notes, and a list of 49 species of birds.

EIFRIG, C. W. G.

A vacation in Quebec.

The Wilson Bulletin, September, 1913, vol. xxv, No. 3, pp. 138-145.

Contains observations on birds at Inlet and High Falls, Labelle Co., Quebec, Doyle, Pontiac Co., Quebec, and Lake Dore, Renfrew Co., Ontario.

FARLEY, F. L.

Is Bartram's Sandpiper disappearing from the Prairies?

The Ottawa Naturalist, August-September 1913, vol. xxvii, Nos. 5 and 6, p. 63.

A statement of the growing scarcity of this bird in central Alberta.

FISHER, MORITZ.

A Vanished Race.

Bird-Lore, March-April, 1913, vol. xv, No. 2, pp. 77-84.

An historical account of the gradual decline in numbers and final extinction of the Passenger Pigeon.

References are made to birds observed near Cape Kildare, on Prince Edward Island, by Jacques Cartier in 1534.

FLEMING, J. H.

Ontario Bird Notes.

The Auk, April, 1913, vol. xxx, No. 2, pp. 225-228.

Contains the first Ontario records of *Mycteria americana*, *Buteo borealis krideri*, *Otocoris alpestris hoyti* and *Calcarius pictus*.

Birds (of the Toronto Region)

The Natural History of the Toronto Region, chap. xvi, pp. 212-237. The Canadian Institute, Toronto, 1913. (Reprints, pp. 1-26).

FORBUSH, E. H.

The last Passenger Pigeon.

Bird-Lore, March-April, 1913, vol. xv, No. 2, pp. 99-103, with one full-page half-tone illustration.

References are made to an alleged capture of this bird at St. Vincent, Quebec, in 1907, and to its breeding in large flocks in Manitoba in 1878.

GOURLAY, REGINALD.

The Vanishing Wild Turkey.

Rod and Gun in Canada, February, 1913, vol. xiv, No. 9, pp. 986-992.

GRINNELL, J.

Two new races of the Pigmy Owl from the Pacific Coast.

The Auk, April, 1913, vol. xxx, No. 2, pp. 222-224.

Contains a description of *Glaucidium gnoma swarthi*, n. subsp., from Errington, Vancouver Island, B.C.

GROH, HERBERT.

The Bartramian Sandpiper.

The Ontario Natural Science Bulletin, 1913, No. 8, p. 52.

Reported from Preston, Ontario.

HALKETT, ANDREW.
Nest of Belted Kingfisher.
The Ottawa Naturalist, August-September, 1913, vol. xxvii, Nos. 5 and 6, p. 70.
Description of a nest found at Meach Lake, Quebec, and acquired by the Canadian Fisheries Museum.

HAULTAIN, NORMAN.
A Record.
The Oologist, June, 1913, vol. xxx, No. 6, p. 100.
Records finding of a nest of the Bartramian Sandpiper at Port Britain, Ontario.
The Greater Yellow Legs.
The Oologist, June, 1913, vol. xxx, No. 6, p. 102.
Reports observation of the Greater Yellow Legs at Carbett's Pond and the Lesser Yellow Legs at Port Britain, Ontario.

HOWE, R. HEBER.
A few notes on Newfoundland Birds.
The Auk, January, 1913, vol. xxx, No. 1, pp. 114-115.
Notes on eight species of birds.

LEWIS, HARRISON F.
The Evening Grosbeak in Nova Scotia.
Bird-Lore, May-June, 1913, vol. xv, No. 3, p. 173.
Notes the occurrence of this bird at Truro, N.S.

MACOUN, JAMES M.
List of the birds noted in Strathcona Park in July and August, 1912.
The Canadian Alpine Journal, 1913, vol. v, pp. 71-72.

MILLER, W. DE W.
Notes on the Plumage of North American Sparrows. Twenty-second Paper
Bird-Lore, July-August, 1913, vol. xv, No. 4, pp. 241-242.
Discusses the plumage of the Pyrrhuloxia (*Pyrrhuloxia sinuata*) and the Cardinal (*Cardinalis cardinalis*).
(See also Chapman, F. M.)

MITCHELL, FRED.
Conditions against which bird life is contending.
The Ontario Natural Science Bulletin, 1913, No. 8, pp. 48-50.

MOORE, ROBERT THOMAS.
The Fox Sparrow as a songster.
The Auk, April, 1913, vol. xxx, No. 2, pp. 177-187, with plate 5.
Musical records of songs of this bird made in the Magdalen Islands, Quebec.

NASH, C. W.
Birds cf Ontario in relation to agriculture.
Ontario Department of Agriculture. Nature Study Series, Bulletin 218 (A revised edition of No. 173), 1913, 124 pp. and 48 figs.

NATURALISTE CANADIEN, LE (Editorial).
Une addition à la faune ornithologique de la province de Quebec.
April, 1913, vol. xxxix, No. 10, p. 145.
Records the capture of *Synthliboramphus antiquus* in the Province of Quebec.

RAINE, WALTER.
Unusual Nesting Sites of the American Merganser, (Merganser americanus).
The Oologist, September, 1913, vol. xxx, No. 9, pp. 139-140 (From the Ottawa Naturalist).

REINECKE, OTTOMAR.
Urinator imber—Loon.
The Oologist, November, 1913, vol. xxx, No. 11, pp. 276-278, with plate showing male and female birds.
Reference is made to the capture of a male at Muskoka Lake.

ROD AND GUN IN CANADA, (Editorial).
The Passenger Pigeon.
January, 1913, vol. xiv, No. 8, p. 886.

SAUNDERS, W. E.
The Hooded Merganser nesting in Southwestern Ontario.
The Ottawa Naturalist, January, 1913, vol. xxvi, No. 10, p. 130.
Reports the nesting of this duck near Guelph.
Lincoln's Sparrow nesting in Bruce County, Ontario.
The Ottawa Naturalist, February, 1913, vol. xxvi, No. 11, pp. 142-143.
Harris's Sparrow in Eastern Ontario.
The Auk, January, 1913, vol. xxx, No. 1, p. 114.
Reports the capture of a male of this species at London, Ontario.
Hudsonian Godwit in the Magdalen Islands.
The Auk, April, 1913, vol. xxx, No. 2, p. 271.
Vanished and Vanishing wild birds.
Rod and Gun in Canada, March, 1913, vol. xiv, No. 10, pp. 1092-1094.

SPEECHLY, H. M.
Bird Note.
The Ottawa Naturalist, December, 1913, vol. xxvii, No. 9, p. 116.
Records the nesting of the goldfinch, *Spinus tristis*, in September, at Pilot Mound, Manitoba.

TERRILL, L. McI.
Bird Notes.
The Ottawa Naturalist, August-September, 1913, vol. xxvii, Nos. 5 and 6, p. 76.
Notes on four species of birds observed on the line of the National Transcontinental Railway, about 50 miles east of Cochrane, Ontario.
Early winter bird notes, 1912-13.
The Ottawa Naturalist, June-July, 1913, vol. xxvii, Nos. 3 and 4, pp. 43-46.

Gives notes on the occurrence and habits of 19 species of birds at Montreal and Bury, Compton County, Quebec.

TOWNSEND, CHARLES W.

Some more Labrador Notes.

The Auk, January, 1913, vol. xxx, No. 1, pp. 1-10, with 2 plates.

Notes on 55 species of birds from the Labrador Peninsula, vicinity of Natushquan River.

TUFTS, HAROLD F.

A nesting season in Nova Scotia.

The Warbler, September, 1913, vol. vii, pp. 9-12.

Contains descriptive notes on the nesting habits of a number of birds observed in the vicinity of Caledonia, Nova Scotia.

WOODCOCK, JOHN.

The Sharp-tailed Grouse in Manitoba.

Bird-Lore, September-October, 1913, vol. xv, No. 5, pp. 291-293, with plate.

WRIGHT, ALBERT HAZEN.

The Passenger Pigeon: Early Historical Records, 1534-1860.

Bird-Lore, March-April, 1913, vol. xv, No. 2, pp. 85-93, with 4 photographic figures.

Contains various references to flights of this bird and to methods of capturing and uses made of it in Canada.

MAMMALIA.

ALLEN, J. A.

Ontogenetic and other variations in Muskoxen, with a systematic review of the Muskox group, recent and extinct.

Memoirs of the American Museum of Natural History, New Series, March, 1913, vol. 1, pt. iv, No. iv, pp. 103-226, with plates xi-xviii and 46 text figures.

BANGS, OUTRAM.

The Land Mammals of Newfoundland.

Bulletin of the Museum of Comparative Zoology, July, 1913, vol. liv, No. 18, pp. 511-516.

Notes are given on the indigenous land mammals, and descriptions of *Mustela cicognathi mortigena*, n. subsp., and *Castor caecator*, n. sp.; and a nominal list of all the Newfoundland mammals.

CRIDDLE, NORMAN.

Gophers of the Prairie Provinces and their control.

I. H. C. Almanac and Encyclopedia, 1914, (Issued about December 20, 1913).

A review of the life history and habits of *Cetellus franklini*, *richardsoni* and *tredecimlineatus*, with methods for their control.

CRIDDLE, NORMAN AND CRIDDLE, STUART.

The Broad Striped Skunk (*Mephitis hudsonicus*, Rich.).

The Ottawa Naturalist, August-September, 1913, vol. xxvii, Nos. 5 and 6, pp. 64-69.

Describes the life histoiy of this animal and the experience of the authors with four captives.

CRIDDLE, STUART.

Zapus princeps minor. A new mouse record for Manitoba.

The Ottawa Naturalist, May, 1913, vol. xxvii, No. 2, p. 30.

Reports this species of jumping mouse from Aweme, Manitoba, and gives a desciiption of it, with ecological notes.

FLEMING, J. H.

Mammals (of the Toronto Region).

The Natural History of the Toronto Region, chap. xv, pp. 206-211. The Canadian Institute, Toronto, 1913. (Reprints, pp. 1-6).

HOLLISTER, N.

A Synopsis of the American Minks.

Proceedings of the United States National Museum, April, 1913, vol. 44, No. 1965, pp. 471-480.

The following forms are reported from various parts of Canada:— *Mustela vison vison* Schreber, *M. vison lacustris* Preble, *M. vison energumenos* (Bangs) and *M. vison ingens* (Osgood).

JONES, J. WALTER.

Fur-farming in Canada.

Commission of Conservation, Canada, 1913.

Report of the 4th Annual Meeting, pp. 42-48.

KOWARZIK, RUD.

Etwas über die Arten der Wildschäfe und ihre Verbreitung.

Zoologischer Anzeiger, March 1913, Bd. xli, Nr. 30, pp. 439-445.

Contains references to the distribution of Canadian species of wild sheep.

LYDEKKER, R.

Catalogue of the Ungulate Mammals in the British Museum (Natural History).

Vol. 1, Artiodactyla, Family Bovidae, Subfamilies Bovinae to Ovibovinae.

London, 1913, pp. xiv + 249.

Contains references to specimens from Canadian localities.

SAUNDERS, W. E.

The Prairie Deer Mouse at London.

The Ottawa Naturalist, January, 1913, vol. xxvi, No. 10, p. 130.

STIRLING, HERBERT LEDLIE.

The Great Western Rabbit Circle.

Rod and Gun in Canada, April, 1913, vol. xiv, No. 10, pp. 1108-1110.
Discusses the migration of hares in western Canada.

VINCENT, SWALE.

The abdominal chromophil body of the dog.

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